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GENERAL

ATOMIC BOMBS AND WARFARE

2535 TID-5252
Army Inst. of Pathology
STATISTICAL ANALYSIS OF THE MEDICAL EFFECTS OF THE ATOMIC BOMBS. (From the Report of the Joint Commission for the Investigation of the Effects of the Atomic Bomb in Japan). Ashley W. Oughterson, George V. LeRoy, Averill A. Liebow, E. Cuyler Hammond, Henry L. Barnett, Jack D. Rosenbaum, and B. Aubrey Schneider. Apr. 19, 1951. TIS issuance date Feb. 28, 1955. 288p.

Formerly issued as NP-3040, "MEDICAL EFFECTS OF ATOMIC BOMBS; THE REPORT OF THE JOINT COMMISSION FOR INVESTIGATION OF THE EFFECTS OF THE ATOMIC BOMB IN JAPAN; VOLUME V."

A detailed statistical analysis is presented of the medical histories of 6882 individuals in Hiroshima and 6621 in Nagasaki who were alive 20 days after the atomic bombings. Burns, mechanical injuries, blast effects, radiation syndrome, hematological data, and death are related to distance from the point on the ground above which the bomb exploded, shielding, age, and sex. (cf. NP-3040.) (C.H.)

2536
ON ATMOSPHERIC RADIOACTIVITY OF ATOMIC ORIGIN. Hubert Garrigue. Compt. rend. 240, 178-80(1955) Jan. 10. (In French)

Measurements of atmospheric radioactivity were made by collecting samples in an airplane over France from October 13 to December 6, 1954. (K.S.)

RESEARCH PROGRAMS

2537
MAJOR ACTIVITIES IN THE ATOMIC ENERGY PROGRAMS JULY-DECEMBER 1954. U. S. Atomic Energy Commission. Washington, D. C., U. S. Government Printing Office, Jan. 1955. 138p. $0.45.

In addition to an extensive outline of AEC research and development activities, several appendixes are included which present portions of AEC regulations governing radioisotope distribution, and a list of current unclassified research contracts. (K.S.)

BIOLOGY AND MEDICINE

2538 ANL-5378
Argonne National Lab.
REPORT ON BIOLOGICAL, MEDICAL AND BIOPHYSICS PROGRAMS. PART I. SEMIANNUAL REPORT OF RADIOLOGICAL PHYSICS DIVISION. PART II. QUARTERLY REPORT ON BIOLOGICAL AND MEDICAL RESEARCH DIVISION. Jan. 1955. 205p. Contract W-31-109-eng-38.

Separate abstracts have been prepared on two sections of this report. (C.H.)

2539 ANL-5378(p.2-64)
Argonne National Lab.
[SECTION 1. RADIOLOGICAL PHYSICS]. p.2-64 of REPORT ON BIOLOGICAL, MEDICAL AND BIOPHYSICS PROGRAMS. PART I. SEMIANNUAL REPORT OF RADIOLOGICAL PHYSICS DIVISION. PART II. QUARTERLY REPORT OF BIOLOGICAL AND MEDICAL RESEARCH DIVISION. Jan. 1955. 63p. Contract W-31-109-eng-38.

Data are presented from studies on the performance of ionization chambers for detection of x and γ radiation; fast neutron dosimetry; calculations of body radium based on expiration of radon in the breath; studies on the movement of water in soil measured by using tritiated water; use of the γ ray emitted during the decay of Ra^{226} as a means of measuring the fractions of radon retained and exhaled in mammals without the need of taking breath samples; the performance of a scintillation counter for counting simultaneously radiations from P^{32} and Cr^{51}; ionization in pure gases and determinations of the average energy required to make an ion pair; drift velocity of electrons in argon; and atmospheric diffusion of smoke. (For preceding period see ANL-5288.) (C.H.)

2540 UCRL-2836
Radiation Lab., Univ. of Calif., Berkeley
HEPARIN-ACTIVATED ENZYME SYSTEM OF HUMAN PLASMA. Bernard W. Shore. Jan. 12, 1955. 8p. Contract W-7405-eng-48.

Further studies have been made on the heparin-catalyzed enzyme of human plasma that liberates free fatty acid from lipoprotein triglycerides. It has been found that the S_f6 lipoprotein of the human is not a substrate for the enzyme, that the tributyrinase activity of serum is not enhanced significantly after heparin injection, and that free fatty acid inhibits the reaction. Such substances as adenosine triphosphate and Coenzyme A, sulfhydryl reagents, aerobiosis, anaerobiosis (with nitrogen), and the antioxidant α-naphthol are without effect. The inhibition of fatty acid release by diisopropylfluorophosphate suggests that the enzyme is an esterase. (auth)

2541
ULTRASONIC RANGING SPEEDS CANCER DIAGNOSIS. John J. Wild and John M. Reid (St. Barnabas Hospital, Minneapolis, Minn.). Electronics 28, No. 3, 174-80(1955) Mar.

More elaborate ultrasonic equipment and techniques for the detection of cancer and identification of tumors are described. The scanning apparatus now in use consists of crystal applicator units (Ethoscopes), an electromagnetic cathode-ray tube display unit, and the basic echo-ranging apparatus. Diagrams and circuitry for the equipment are presented, as well as photographs of results. (L.M.T.)

2542
HANDBOOK OF RADIOLOGY. Russell H. Morgan and

Kenneth E. Corrigan, eds. Chicago, The Year Book Publishers, Inc., 1955. 518p.

Quantitative data useful to workers engaged in the clinical, experimental, and industrial applications of ionizing radiation are summarized. Sections are included covering definitions of physical terms and units, general biophysical data, radiotherapeutic data, data on radioisotopes of medical and biological interest, radiography and fluoroscopy, and radiation protection. Data are appended on common drugs used in radiography and useful mathematical tables. (C. H.)

2543

COMPARISON OF THYROID LOBES, AUTOTRANSPLANTED AND IN SITU, IN THE RAT. GROWTH AND I^{131} UPTAKE. Seymour H. Wollman and Robert O. Scow (National Cancer Inst. and National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). J. Natl. Cancer Inst. 15, 943-7(1955) Feb.

A comparison was made of growth characteristics and radioiodide uptake of autotransplanted thyroid lobes and lobes in situ in the same rats. Although autotransplanted lobes were always smaller than lobes in situ their clearance of radioiodide from the blood was not significantly different per unit weight of tissue. No significant difference was found in their response to hypophysectomy or propylthiouracil feeding. (auth)

2544

DISTRIBUTION OF RADIOACTIVE PHOSPHORUS AND IODINE IN ORGANS OF THE RABBIT IN NORMAL CONDITION, IN PENTOTHAL NARCOSIS, AND UNDER INTENSE STIMULATION. I. I. Fedorov, P. K. Khodosevich, Z. P. Fedorova, and E. A. Gosteva (Lvov Research Inst. for Blood Transfusion). Doklady Akad. Nauk S.S.S.R. 100, 393-6(1955) Jan. 11. (In Russian)

2545

SPONTANEOUS TUMORS OF SMALL LABORATORY ANIMALS AMD THEIR IMPORTANCE FOR EXPERIMENTAL ONCOLOGY. Christiane Tamaschke. Strahlentherapie 96, 150-68(1955) Jan. (In German)

On the basis of a critical compilation of cases published in literature, a survey is presented on 930 spontaneous tumors observed in small laboratory animals (95 cases in rabbits; 17 in guinea pigs; 173 in rats and 645 in mice). The ratio of benign to malign tumors as well as that of sarcoma to carcinoma is discussed, and reference is made to the predisposition of certain organs to the formation of tumors which predisposition is characteristic for the different species. The findings are compared to the results of previous investigations on the appearance of tumors in domestic mammals. The importance of the age factor in spontaneous and experimentally induced tumors is stressed. (auth)

RADIATION EFFECTS

2546 AECU-2977

LOBUND Inst., Univ. of Notre Dame

STATUS REPORT OF LOBUND STUDY ON COMPARATIVE EFFECTS OF TOTAL BODY RADIATION. Helmut A. Gordon and William C. Scruggs. Nov. 16, 1953. 16p. Sponsored by ONR and AEC under Contract N6-ori-83, T. O. 3.

Preliminary results are reported from a study of the radiation syndrome in germ-free rats. At radiation doses between 700 r and 1000 r the lack of bacteria apparently prolongs life but does not save it. At the 400 and 600 r dose level the germ-free state of the animal definitely reduces mortality and prolongs life. Histological observations indicate that in fatally affected germ-free rats the radiation syndrome progresses beyond the conventional picture to an ulterior, pathologically severer endpoint in which highly depleted bone marrow, low rate of erythropoiesis, a considerable degree of fatty degeneration in the heart and liver, and vacuolar degeneration in the liver are observed. Preliminary observations from a study of the effects of single bacterial contaminants upon the radiation syndrome of germ-free animals are included. (C.H.)

2547 ANL-5378(p.65-186)

Argonne National Lab.

[SECTION II. BIOLOGICAL AND MEDICAL RESEARCH]. p.65-186 of REPORT ON BIOLOGICAL, MEDICAL AND BIOPHYSICS PROGRAMS. PART I. SEMIANNUAL REPORT OF RADIOLOGICAL PHYSICS DIVISION. PART II. QUARTERLY REPORT OF BIOLOGICAL AND MEDICAL RESEARCH DIVISION. Jan. 1955. 122p. Contract W-31-109-eng-38.

Progress is reported in studies of physiological effects produced by the presence of ascites tumor cells; microscopic studies on tumor nuclei irradiated with point β sources; urinary and fecal excretion of simultaneously injected Ra^{226} and Ca^{45} in dogs; the effect of surgical trauma on survival following low-rate x irradiation of chicks; the rate of urea formation in irradiated nephrectomized rats; the effect of x irradiation on the dry weight and protein content of regressing embryos; dosimetry based on phantom studies of depth dose of low-energy x radiation for mice, rats, and rabbits; calibration of equipment of low-level γ rooms for duration-of-life irradiation of experimental animals; recovery and regeneration of mouse spleens after single and divided doses of x irradiation; the effects of irradiation on egg yolks; the lethal effects of intravenously injected fission product radioruthenium in mice; malignant bone tumors following administration of Sr^{89} in mice; the daily probability of death of mice exposed to fast neutrons of Co^{60} gamma radiation; thermal neutron contribution to fast neutron exposure; the biosynthesis of methylthioadenosine; investigations of the indole-3-acetic acid oxidase, tryptophan-indoleacetic acid, tryptophan peroxidase, orgirase, and ribonuclease systems; tracer studies of purine synthesis and glycine metabolism by E. coli; growth of Paramecium; tracer studies of the effects of temperature on phosphate release from dog erythrocytes; the use of plastics in the preparation of thin sections of undecalcified bone for radioautograms; the mechanism of spleen protection against radiation injury; a statistical analysis of the blood picture from a normal human population; and the control of murine mange in laboratory mice. (For preceding period see ANL-5332.) (C.H.)

2548 NP-5526

Air Force Radiation Lab., Univ. of Chicago

QUARTERLY PROGRESS REPORT NO. 14. Jan. 15, 1955. 104p. Contract AF-33(038)-27353.

Progress is reported on studies of the effects of ionizing radiations on the biochemistry of mammalian tissues; the influence of high temperature and other enviornmental factors on the susceptibility of animals to the injurious actions of ionizing radiations; and testing of various pharmacological and toxicological compounds as protective agents against radiation injury in experimental animals. Data are included on the pharmacological effects of cho-

linergic drugs and mercurial diuretics for mice and rats and the influence of x irradiation on the metabolism and excretion of phenol in rats. (For preceding period see NP-5419.) (C.H.)

2549 NP-5543

Quartermaster Food and Container Inst., Chicago

RADIATION STERILIZATION. REVIEW OF THE LITERATURE IN SELECTED FIELDS. Feb. 1955. 74p.

Results are summarized from a literature survey of studies on subjects related to the radioinduced sterilization of food. Topics discussed include the effects of ionizing radiation on proteins, lipids, carbohydrates, vitamins, enzymes, and meats, and the radiation sensitivity of spoilage microörganisms. 200 references. (C.H.)

2550 UCLA-324

Atomic Energy Project, Univ. of Calif., Los Angeles

THE EFFECTS OF CRITICAL DOSAGES OF GAMMA IRRADIATION UPON THE CAPACITY OF THE PITUITARY GLAND OF BUFO TO SECRETE THYROTROPHIC HORMONE. Bennet M. Allen and Betty L. Bachman. Feb. 18, 1955. 35p. Contract AT-04-1-GEN-12.

Pituitary glands of recently metamorphosed donor toads which had been subjected to gamma irradiation in dosages varying from 5,000 to 60,000 r were dissected out and transplanted into immature host tadpoles that were killed at the end of 20 days. Their output of thyrotrophic hormone was measured by the activity of the host thyroid glands as indicated by hind limb growth and the tendency to shedding of the cuticular larval teeth. Gamma irradiation up to and including 30,000 r did not reduce the capacity of the pituitary transplant to induce a tendency toward metamorphosis during the 20 days of the experiment. From this point on the successively higher exposures caused progressive loss in capacity to secrete thyrotrophic hormone until at 60,000 r the influence of the thyroid gland upon hind limb growth and shedding of cuticular teeth ceased. Irradiation of 25,000 r brings about a decrease in the number of acidophile cells. At the higher levels of irradiation, 40,000 r and above, there is a high degree of variation in the condition of the transplant. In some cases there is abnormal proliferation of connective tissue. More heavily irradiated transplants induce the growth of cartilage excrescences from the otic capsule at points closest to the transplant. Sections of the thyroid glands showed a state of activity maintained at a high level after pituitary transplant irradiation up to 27,000 r but heavier dosages reduced their capacity for secretion of throtrophic hormone. (auth)

2551 UCRL-2823

Radiation Lab., Univ. of Calif. Berkeley

MEDICAL AND HEALTH PHYSICS QUARTERLY REPORT [FOR] JULY, AUGUST, SEPTEMBER 1954. Nov. 23, 1954. 53p. Contract W-7405-eng-48.

Data are presented from tracer studies of the tissue distribution of Sm, Eu, Dy, Ho, and Yb in rats; pathological effects of At^{211} on rats and monkeys; and studies of the radiation chemistry of aqueous solutions of acetic acid, glycine, and formic acid. Routine health chemistry activities are summarized. (For preceding period see UCRL-2661.) (C.H.)

2552

POTATO STORAGE AND GAMMA-RADIATION. J. Evans. Atomics 6, 47-51(1955) Feb.

Results of experiments that have been conducted by Brookhaven National Lab. on the use of ionizing radiation in connection with the extended storage life of potatoes are summarized. (L.M.T.)

2553

THE HISTOPATHOLOGY OF BACTERIAL INFECTION IN IRRADIATED MICE. Charles C. Congdon, Fletcher P. Williams, Jr., Robert T. Haberman, and Egon Lorenz (National Cancer Inst. and National Inst. of Arthritis and Metabolic Diseases, Bethesda, Md.). J. Natl. Cancer Inst. 15, 855-75(1955) Feb.

The lesions observed in the intestine following exposure to radiation probably represent one portal of entry for the bacterial infection at this exposure level. The pathogenesis of the disease depends on the existence of a bacteremia that rapidly progresses to a fulminating septicopyemia in which purulent exudation is lacking. (auth)

2554

THE EFFECT OF FRACTIONATED X-RAY DOSAGE UPON THE MOUSE TESTIS. I. MAXIMUM WEIGHT LOSS FOLLOWING 80 TO 240 r GIVEN IN 2 TO 5 FRACTIONS DURING 1 TO 4 DAYS. Henry I. Kohn and Robert F. Kallman (Univ. of California School of Medicine, San Francisco). J. Natl. Cancer Inst. 15, 891-9(1955) Feb.

Following exposure to x rays, radiologic injury in the germinal epithelium of adult CAF_1 mice was measured by the maximum loss of testicular weight, which in the experiments occurred at about 4 weeks after irradiation. The effects of undivided and fractionated dosage were compared. The total dose was varied from 80 to 240 r (tissue). The number of fractions was varied from 2 to 5, given in 1 to 4 days' elapsed time. Physically equipotent biologically equipotent, and nonequipotent fractions were used. Data are tabulated, and results are discussed. (C. H.)

2555

ON WASTED RADIATION AND THE INTERPRETATION OF EXPERIMENTS WITH CHRONIC IRRADIATION. R. H. Mole (Atomic Energy Research Establishment, Harwell, Berks, England). J. Natl. Cancer Inst. 15, 907-14(1955) Feb.

The effects of continued daily irradiation until death and of a limited exposure to daily irradiation are contrasted. The killing efficiency per roentgen of a limited exposure is much greater than for continued irradiation because so much of the continued irradiation is wasted. When allowance is made for wasted radiation, the pattern of dose and effect for chronic irradiation is markedly altered. The irreversible consequences of a limited exposure are quantitatively important. (auth)

2556

RESULTS OF EXPOSURE OF NEWBORN STRAIN HR MICE TO X RADIATION. Margaret K. Deringer and Egon Lorenz (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 923-9(1955) Feb.

A total dose of 400 r x radiation failed to increase the incidence of papillomas of the skin in strain HR mice, but a decrease in the average age of appearance of the papillomas was noted. A few squamous-cell carcinomas were observed in the irradiated hairless animals. The number of ovarian tumors was increased in irradiated strain HR females as compared with that in control females. Damage to the ovaries and testes of the strain HR animals was the principal result of the exposure to a total dose of 400 r x radiation within 12 hours following birth. (auth)

2557

FERTILITY AND TUMOR DEVELOPMENT IN (C57L X A)F_1 HYBRID MICE RECEIVING X RADIATION TO OVARIES ONLY, TO WHOLE BODY, AND TO WHOLE BODY WITH OVARIES SHIELDED. Margaret K. Deringer, Egon Lorenz, and Delta E. Uphoff (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 931-41(1955) Feb.

2558

NUCLEIC ACID CONTENT OF THE THYMIC CELLS OF NORMAL AND IRRADIATED C57BL MICE. Patricia P. Weymouth, Norman E. Delfel, Ruth J. Doell, Helene L. Steinbock, and Henry S. Kaplan (Stanford Univ. School of Medicine, San Francisco, Calif.). J. Natl. Cancer Inst. 15, 981-90(1955) Feb.

2559

SPONTANEOUS AND RADIATION-INDUCED PITUITARY ADENOMAS OF MICE. Arthur C. Upton and Jacob Furth (Oak Ridge National Lab., Tenn.). J. Natl. Cancer Inst. 15, 1005-21(1955) Feb.

Tumors of the adenohypophysis developed spontaneously in LAF_1 mice, appearing first at about two years of age and occurring in more than 8 percent of females surviving three years. The incidence of such tumors was increased by a single whole-body exposure to ionizing radiation, and tumor-formation was hastened in proportion to the dose. The neoplasms were four to five times more common in females than in males. The adenomas were composed of cells predominantly chromophobic although containing in the cytoplasm varying numbers of coarse acidophilic granules; most neoplasms also contained at least a few heavily granulated acidophils which were interpreted as tumor cells. The pituitary-tumor-bearing females exhibited alveolar hyperplasia and distension of mammary gland ducts, which were also occasionally present to a lesser degree in aging females without pituitary tumors. (auth)

2560

SUCCESSFUL SKIN HOMOGRAFTS AFTER THE ADMINISTRATION OF HIGH DOSAGE X RADIATION AND HOMOLOGOUS BONE MARROW. Joan Michel Main and Richmond T. Prehn (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1023-9(1955) Feb.

2561

EFFECT OF LOCAL ROENTGEN IRRADIATION OF THE FORMATION OF NEW CAPILLARIES AFTER INJURY. Ruth M. Merwin and Elizabeth L. Hill (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1031-7(1955) Feb.

Studies were made on the effect of irradiation on the formation of new capillaries in injuries in the skin of mice. Doses of 400 to 1,500 roentgens were given, and within 6 hours the skin was injured by a small burn or by inserting a stitch of tantalum wire. A dose of 500 r slowed the rate of revascularization of the burned areas but had no effect on the time of vascularization of the coating of exudate that formed around tantalum wires. As the dose of radiation was increased from 500 to 1,500 roentgens the rate of revascularization of burned areas decreased and the interval before capillaries began to invade the coating around wires increased. The new network of vessels in both types of injuries was sparser following doses of radiation that exceeded 700 roentgens than it was following lower doses. (auth)

2562

STUDY OF RECOVERY AT LOW TEMPERATURE OF X-IRRADIATED E. COLI CELLS. A. W. Pratt, W. S. Moos, and M. Eden (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1039-47(1955) Feb.

The recovery of Escherichia coli cells from x irradiation has been examined as a function of time stored in the cold in distilled water suspensions, citrate suspensions, and broth suspensions. Some degree of recovery was observed in all irradiated cell suspensions. It is suggested that the mechanism of recovery is intrinsic to the cell. (auth)

2563

LONG-TERM EFFECTS OF ACUTE AND CHRONIC IRRADIATION IN MICE. I. SURVIVAL AND TUMOR INCIDENCE FOLLOWING CHRONIC IRRADIATION OF 0.11 r PER DAY. Egon Lorenz, Joanne Weikel Hollcroft, Eliza Miller, Charles C. Congdon, and Robert Schweisthal (National Cancer Inst., Bethesda, Md. and Argonne National Lab., Chicago, Ill.). J. Natl. Cancer Inst. 15, 1049-58(1955) Feb.

LAF_1 male mice exposed to γ radiation of radium at a dose level of 0.11 r per 8-hour day from 1 month of age until death had a mean survival time of 783.1 days while that of nonirradiated LAF_1 male mice had a mean survival time of 683.5 days. This increase of 99.6 days is significant at the 0.01 level. LAF_1 female mice similarly exposed had a mean survival time of 820.4 days as compared to 802.9 days of the controls. This increase of 17.4 days is not significant. An increase in the incidence of lymphosarcomas and other tumors of the reticular tissues occurred in both the male and female irradiated mice. Mammary carcinoma incidence was also higher in the irradiated animals. The increase in both cases was statistically significant at the 0.01 level. In addition, the irradiated females showed an increase in ovarian tumors and the irradiated males showed an increase in lung tumor incidence. (auth)

2564

LONG-TERM SURVIVAL FOLLOWING X IRRADIATION AND THE IRRADIATION OF THE α PARTICLES FROM RADON AND ITS DECAY PRODUCTS. Joanne Weikel Hollcroft, Egon Lorenz, Marion Matthews, and Charles C. Congdon (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1059-69(1955) Feb.

Strain A male mice were treated with 400 r x irradiation injected with a dose of radon in equilibrium with its daughters such that the absorbed energy was equivalent to that of 400 r, or kept as controls. The mean survival time of the x-irradiated animals was found to be 425, that of the radon-treated mice 165 days, and that of the controls 377 days. A small serial killing study was done on mice treated similarly that showed that the shortened life span following radon treatment could be explained by renal damage, which was not found in mice of the other groups. An early kidney damage was also seen in the week following radon injection. In addition, data obtained on the storage of RaD in the body indicated that RaD remained in the femur, sternum and kidneys, although it was eliminated from other tissues relatively rapidly. The kidney dose from RaD, RaE, and polonium after injection of 0.016 mc. per gm. of radon in equilibrium with its short-lived decay products was estimated to be 1,550 ergs per gram or 17r. These findings indicate that the kidney damage caused by a high dose of irradiation from α particles may be in part responsible for acute deaths following radon administration. Since this damage is not seen following x irradiation in the LD_{50} range, the calculation of

relative biological effectiveness based on an LD_{50} dose of radon as compared to x ray is not valid. (auth)

2565

EFFECTS OF COMBINED LOCAL TREATMENT WITH RADIOACTIVE AND CHEMICAL CARCINOGENS. Arthur M. Cloudman, Katherine A. Hamilton, Ralph S. Clayton, and Austin M. Brues (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 15, 1077-83(1955) Feb.

A carcinogenic hydrocarbon (methylcholanthrene) and β-ray sources (P^{32} and Y^{91}) were applied, together and separately, to the skin and to the subcutaneous tissues of mice. Carcinogenic effects of the two agents applied to skin were approximately additive, although there was a suggestion of some synergism between them in the production of papillomas. The two agents were somewhat less than additive when given in the form of subcutaneous pellets. It is suggested that destruction of a local area of methylcholanthrene effectiveness by the high-radiation dose to this area may be responsible for this. Application of methylcholanthrene to the skin of young adult mice in an amount of 1.7 mg. in a single painting shortens survival of mice by about one third. This effect is not shared by superficial β irradiation in carcinogenic doses, by implantation of pellets containing carcinogenic doses of hydrocarbons or β emitting agents, or by the benzene solvent applied to the skin. (auth)

2566

AMINOACIDURIA FOLLOWING TOTAL-BODY IRRADIATION IN THE HUMAN. Elaine J. Katz and Robert J. Hasterlik (Argonne National Lab., Lemont, Ill.). J. Natl. Inst. 15, 1085-1107(1955) Feb.

Following the accidental exposure of four laboratory workers to total-body irradiation with γ rays and neutrons at levels between 25 and 180 rep (roentgens equivalent physical), total daily urinary amino-acid excretion increased to as high as ten times normal values. The quantities of individual amino acids excreted varied from two to twenty times normal amounts. The most marked excretion occurred with hydroxy-proline and glycine. Abnormal excretion in both number and quantity of amino acids occurred as early as 12 hours following the initial exposure, indicating that the physiologic changes had become operative before this time. Abnormal amino-acid levels were evident 5 months following exposure. Aminoaciduria is a sensitive and early indicator of low levels of radiation exposure. There was no direct quantitative relationship between the radiation level and the degree of aminoaciduria. It is believed that the aminoaciduria occurring after irradiation might result from the following: decreased oxidation and utilization of amino acids by the liver and other tissues; adrenal response to a stress situation; changes in the threshold of renal tubular resorption of amino acids; increased protein (tissue) breakdown. In view of the response to an exposure of 25 rep, it is postulated that increased protein breakdown is not a major factor in producing the aminoaciduria found in these patients. (auth)

2567

A COMPARATIVE ANALYSIS OF RADIATION LETHALITY IN MAMMALS EXPOSED AT CONSTANT AVERAGE INTENSITY FOR THE DURATION OF LIFE. George A. Sacher (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 15, 1125-44(1955) Feb.

Existing data are reviewed on radiation lethality in mice, rats, rabbits, dogs, guinea pigs, monkeys, and burros. Relevent information is tabulated on species, strain, sex, radiation quality, length of exposure, daily dosages, and treatment pattern. The relation between survival time and the underlying physiologic injury process is analyzed mathematically. (C. H.)

2568

LEVEL OF PROTEIN INTAKE AND NITROGEN EXCRETION IN RATS FOLLOWING TOTAL-BODY X IRRADIATION. Julius White, Bernard E. Burr, Harriett T. Cool, Philip W. David, and Mona S. Ally (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1145-54(1955) Feb.

Rats fed a low protein diet show a marked increase in nitrogen excretion, while those ingesting a 15- or 20-percent casein diet show a much lower increase in nitrogen excretion when given 450 to 500 r total-body x irradiation. These increases in nitrogen excretion are to a great extent due to increased urea excretions and suggest increased protein catabolism. Food intake in all 3 groups is markedly reduced during the first 3 or 4 days following x irradiation. As a result of radiation exposure, loss of appetite ensues, and coupled with radiation effects, demands for energy from endogenous sources are increased. Shielding the spleen in the C-6 group during x irradiation results in partial protection against increased nitrogen excretion following radiation exposure. (auth)

2569

CIRRHOSIS OF THE LIVER IN RATS FOLLOWING TOTAL-BODY X IRRADIATION. Julius White, Charles C. Congdon, Philip W. David, and Mona S. Ally (National Cancer Inst., Bethesda, Md.). J. Natl. Cancer Inst. 15, 1155-63(1955) Feb.

Rats fed a low protein diet developed cirrhosis of the liver in 53 percent of the animals which survived 450 or 500 r total-body x irradiation. Rats fed either a 15- or 20-percent casein diet, or a diet in which the 15-percent casein was replaced by an amino acid mixture for a 30-day period, did not show cirrhosis for periods as long as 400 days following 450 or 500 r total-body x irradiation. Pulmonary infection was a prominent cause of death in most of the groups of irradiated rats. (auth)

2570

THE EFFECT OF LOW VOLTAGE ELECTRONS ON THE LATENT PERIOD OF T1 BACTERIOPHAGE. Marguerite Davis and Ernest Pollard (Yale Univ., New Haven, Conn.). Radiation Research 2, 47-9(1955) Feb.

Low-voltage electron bombardment of T1 bacteriophage shows that the property concerned with the length of the period is situated deep inside the virus, probably at a depth exceeding 100 A. (auth)

2571

INFLUENCE OF EXTENDED TEMPERATURE TREATMENTS ON RECOVERY OF X-IRRADIATED ASCARIS EGGS. C. S. Bachofer and George Pahl (Univ. of Notre Dame, Ind.). Radiation Research 2, 50-63(1955) Feb.

X-irradiation of eggs of Ascaris lumbricoides suum produces cleavage delay and interferes with normal embryogenesis. This cleavage delay remains unchanged when irradiated eggs, held at 0°C and 5°C for periods up to 35 weeks, are subsequently incubated at 30°C in order to inititate cell division. Survival shows a continuous decrease over a period of 35 weeks of post-irradiation exposures at 0°C and 5°C on subsequent incubation at 30°C. This decrease is most marked as a result of the first month of storage at low temperatures. For maximum survival the post-irradiation temperatures should approximate that for maximum biological activ-

ity. At this temperature restoration of essential cellular constituents and/or elimination of toxic irradiation products can best be accomplished, and it appears that some phase of metabolism is necessary to accomplish this. The decrease in survival resulting from exposure to low temperatures after irradiation may be due in part to the action of low temperature itself, which brings about depletion of the minimal essential components needed for development and is evidenced even in unirradiated controls. Over a period of one month at post-irradiation temperatures below 25°C there is a complex pattern of survival. After 1 day there is a uniform decrease in survival with each decrease in temperature. After 1 week, the complexity involves bimodal curves. At post-irradiation temperatures from 35°C to 50°C there is a decrease in survival with each corresponding increase in temperature. Irradiated eggs are more sensitive to post-irradiation temperatures above the optimal 30°C than are unirradiated eggs. (auth)

2572

CHANGES IN RESPIRATORY GASES OF BURROS AFTER PROLONGED FRACTIONATED TOTAL-BODY γ-IRRADIATION. John J. Lane, James L. Wilding, John H. Rust, Bernard F. Trum, and Joseph C. Schoolar (Atomic Energy Commission, Agricultural Research Progran, Oak Ridge, Tenn.). Radiation Research 2, 64-70(1955) Feb.

Metabolic studies have been carried out with total-body irradiated and with fasted nonirradiated burros. It was found that the R.Q. of the irradiated and fasted nonirradiated animals decreased, but that the R.Q. decreased much more drastically in animals irradiated with 200 r/day of total-body cobalt-60 γ-irradiation than with 25-r/day group. With the 25-r/day group and in the fasted nonirradiated animals the decrease was similar although the food consumption of the irradiated animals did not change. Oxygen consumption was reduced in both fasted and 200-r/day groups but not in the 25-r/day group. The carbon dioxide expired was reduced significantly in both dose groups. Weight loss of the irradiated and fasted controls was very similar. The blood pyruvate level was increased on the twentieth day of irradiation and remained high until death. (auth)

2573

ANDROGENESIS AS EVIDENCE FOR THE NATURE OF X-RAY-INDUCED INJURY. Anna R. Whiting (Univ. of Pennsylvania, Philadelphia). Radiation Research 2, 71-8(1955) Feb.

Irradiated cytoplasm of Habrobracon eggs was found to function normally after exposure to doses of x rays many times greater than that lethal to the nucleus. High doses of irradiation prevented normal function, even in combination with an uninjured nucleus. The phenomenon of androgenesis was used as a source of evidence. (C.H.)

2574

RESISTANCE OF COENZYME A TO X-IRRADIATION. Kenneth P. DuBois, Gladys J. Cotter, and Donald F. Petersen (Univ. of Chicago, Ill.). Radiation Research 2, 79-83 (1955) Feb.

The influence of whole-body x-irradiation on the ability of rats and guinea pigs to acetylate sulfanilamide was determined by measuring the urinary excretion of acetylsufanilamide. Doses of 400 r, 600 r, and 800 r had no influence on the acetylation of sulfanilamide by rats. After 1200 r of x ray rats exhibited no alteraion in ability to acetylate sulfanilamide throughout the survival time. The ability of guinea pigs to acetylate sulfanilamide was not altered by 400 r and 800 r of x ray. It was, therefore, concluded that x irradiation does not significantly alter the functional activity of the coenzyme A of the liver in vivo. (auth)

2575

X-RAY-INDUCED "STICKINESS" OF THE CHROMOSOMES OF THE CHORTOPHAGEA NEUTROBLAST IN RELATION TO DOSE AND MITOTIC STAGE AT TREATMENT. J. Gordon Carlson and Nyra G. Harrington (Univ. of Tennessee, Knoxville and Oak Ridge National Lab., Tenn.). Radiation Research 2, 84-90(1955) Feb.

Observations of x-rayed hanging-drop preparation of grasshopper neutroblats in artifical medium at short time intervals immediately after treatment demonstrate that of the mitotic stages examined, namely, very late prophase, prometaphase, metaphase, and anaphase, the earlier the stage, the greater the effect for a given dose. This may indicate either that a positive correlation exists between the degree of "stickiness" produced and the time interval available for it to develop between treatment and detection or that the susceptibility of the chromosomes to this effect diminishes as cells progress through the mitotic stages studied. (auth)

2576

A COMPARISON OF THE EFFECTIVENESS OF RADIATIONS OF DIFFERENT ENERGIES IN PRODUCING CHROMOSOME BREAKS. T. J. Arnason and Margaret Morrison (Univ. of Saskatchewan, Saskatoon, Canada). Radiation Research 2, 91-5(1955) Feb.

2577

THE EFFECT OF IONIZING RADIATION ON THE PHAGOCYTOSIS AND THE BACTERICIDAL POWER OF THE BLOOD. I. THE EFFECT OF RADIATION ON MIGRATION OF LEUCOCYTES. I. L. Shechmeister and M. Fishman (Washington Univ. School of Dentistry and School of Medicine, St. Louis, Mo.). J. Exptl. Med. 101, 259-74(1955) Mar.

Exposure of rats to 600 r total body radiation did not influence either the rate or the extent of migration of their leucocytes 1 day after irradiation, but did decrease their migration on the 2nd and the 5th postirradiation day. Migration of rat leucocytes was not altered by infection of the animal with M. aureus. Leucocytes of rabbits irradiated with 100 r showed a normal rate and extent of migration. However, rabbits exposed to 500 r or 800 r showed depression of leucocyte migration at two postirradiation intervals, on the 3rd to 5th and the 10th to 13th days after irradiation, with normal activity intervening. By the 21st postirradiation day the ability of leucocytes to migrate returned to normal. The effect of radiation on total and differential leucocyte counts and the relationship of this effect to migration is discussed. The decrease in leucocyte migration could not be ascribed either to leucopenia or to plasma factors. (auth)

2578

THE EFFECT OF IONIZING RADIATION ON PHAGOCYTOSIS AND THE BACTERICIDAL POWER OF THE BLOOD. II. THE EFFECT OF RADIATION ON INGESTION AND DIGESTION OF BACTERIA. M. Fishman and I. L. Shechmeister (Washington Univ. School of Medicine and School of Dentistry, St. Louis, Mo.). J. Exptl. Med. 101, 275-90(1955) Mar.

Rats irradiated with 600 r (total body) showed increased indices of both opsonophagic and surface phagocytosis 2, 12, and 24 hours after irradiation. The indices decreased 72 hours after exposure and returned to normal by the 4th to 5th postirradiation day. Bactericidal power of the blood of

irradiated animals was depressed when measured 3 and 6 days after exposure to x rays. Decomplemented serum from irradiated animals was more bactericidal against M. aureus than decomplemented serum from the control rats. This bactericidal substance was destroyed at 78°C. and was found not to require any complement or specific antibodies for action. Extracts of leucocytes from animals 3 days after irradiation demonstrated no bactericidal activity against M. aureus, while extracts from the control animals or rats 1 day after irradiation were actively bactericidal. The extracts from leucocytes of nonirradiated animals were thermolabile, nondialyzable, had a pH optimum of 7.5, and were capable of being precipitated by NH_4SO_4 and of calcium phosphate fractionation. The observed increase in susceptibility of irradiated rats to infection with M. aureus was correlated not only with granulopenia but also with the alteration of the above indicated functions of the granulocytes of the irradiated animals. (auth)

2579

THE EFFECT OF IONIZING RADIATION ON DEOXYRIBONUCLEASE ACTIVITIES OF BODY FLUIDS. II. THE PLASMA DNases AFTER TOTAL BODY IRRADIATION. O. D. Kowlessar, K. I. Altman, and L. H. Hempelmann (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Arch. Biochem. Biophys. 54, 355-8(1955) Feb.

The activity of DNase I and DNase II is markedly elevated in the plasma of irradiated rats. The maximum activity of DNase I occurs 6 days after exposure whereas the peak activity of DNase II occurs 1 day after exposure. (auth)

2580

DECREASE IN UPTAKE OF IRON BY DUCK ERYTHROCYTES IN VITRO FOLLOWING WHOLE-BODY X-IRRADIATION. J. Raymond Klein (Brookhaven National Lab., Upton, N. Y.). Arch. Biochem. Biophys. 54, 556-7(1955) Feb.

2581

EFFECT OF Co^{60} GAMMA RADIATION ON THE PROCESS OF OVULATION, FERTILIZATION, AND EMBRYONIC DEVELOPMENT OF THE FROG. A. V. Voino-Yasenetskii. Doklady Akad. Nauk S.S.S.R. 100, 389-91(1955) Jan. 11. (In Russian)

2582

EFFECT OF HIGH-INTENSITY X-RADIATION ON VELOCITY OF NERVE CONDUCTION. Herbert B. Gerstner, John S. Orth, and Everett O. Rickey (U. S. Air Force School of Aviation Medicine, Randolph Field, Texas). Am. J. Physiol. 180, 232-6(1955) Jan.

Sciatic nerves of bullfrogs and rabbits were isolated and stored at 24°C. Conduction velocity was determined prior to and at 1, 2, and 4 hours following exposure to various total doses at dose rates of approximately 9 kr (9,000 r)/min. of x radiation. Data on the irradiated nerves are compared with data on nonirradiated controls obtained from the same animals. In frog nerves, doses in excess of 75 kr caused a decrease in conduction velocity; doses above 300 kr produced complete abolishment of nerve conduction within 1 hour following irradiation. Rabbit nerves proved to be much more radiosensitive than frog nerves. Doses in excess of 45 kr produced complete block within 1 hour following irradiation. (auth)

2583

COMPARATIVE-CYTOLOGICAL INVESTIGATION OF THE EFFECT OF LOW DOSES OF X RAYS AND RADIUM ON INTUSSUSCEPTION IN THE PERICARP OF SPRING RYE. L. P. Breslavets (Inst. of Biological Physics, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R. Ser. Biol., No. 6, 38-51(1954) Nov.-Dec. (In Russian)

2584

THE EFFECTS OF X RAYS ON DIVISION RATE AND SURVIVAL OF TILLINA MAGNA AND COLPODA SP. WITH AN ACCOUNT OF DELAYED DEATH. Josephine Bridgman and R. F. Kimball (Oak Ridge National Lab., Tenn.). J. Cellular Comp. Physiol. 44, 431-45(1954) Dec.

2585

THE EFFECTS OF X IRRADIATION ON BRISTLES OF DROSOPHILA MELANOGASTER. B. Naville. Oncologia 8, No. 1, 55-67(1955). (In German)

The 5-hours' old chrysalis stage of Drosophila melanogaster were irradiated with 180 kv and 31 Mev x rays, and the damage to the bristles investigated. The individual bristles showed a variable radiosensitivity and showed a linear damage curve with increasing dose. As the damage curve appeared to be quite regular, one can conclude that there must be already cells present in the 5-hours chrysalis stage which determine the development of the bristle pattern. The x ray modifications represent phaenocopies of known mutations, and the x ray effect could therefore be explained through chromosomal damage. (auth)

2586

LEUKEMOGENIC EFFECTS OF IONIZING RADIATION ON ATOMIC BOMB SURVIVORS IN HIROSHIMA CITY. William C. Moloney and Marvin A. Kastenbaum (Atomic Bomb Casualty Commission, Hiroshima, Japan). Science 121, 308-9 (1955) Feb. 25.

Classification of survivors of the atomic bomb explosion in Hiroshima according to distance from the hypocenter and degree of irradiation permitted statistical confirmation of the suspected high incidence of leukemia among the survivors. (C.H.)

2587

THE RESPONSE OF ADENOSINETRIPHOSPHATASE TO A SINGLE RADIATION WITH DIFFERENT HIGH RADIATION DOSES IN VITRO. Th. Hornykiewytsch and H. St. Stender. Strahlentherapie 96, 100-6(1955) Jan. (In German)

The author reports on in vitro irradiations, with doses from 0.5 to 100 kr, of diluted liver and muscle homogenates, containing adenosinetriphosphatase. With increasing dilution, the extent of inactivation of the ferments relative to the percentage of water increases up to an optimum. Or the basis of the results, it seems unlikely that irradiations are exerting a direct influence on the ATPase in the cells. (auth)

2588

CHANGES IN THE CENTRAL NERVOUS SYSTEM FROM LOCAL EFFECTS OF X RADIATION. P. F. Minaev (Inst. of Biological Physics). Zhur. Obshchei Biol. 15, 401-12 (1954) Nov.-Dec. (In Russian)

Histological, metabolic, and conditioned-reflex changes following irradiation of various portions of the brains of dogs, chickens, and rabbits with 500, 7000, or 30,000 r are described. 13 figures. (G.Y.)

RADIATION HAZARDS AND PROTECTION

2589 AECU-2967

Isotopes Div., Radiological Safety Branch, AEC

RADIATION SAFETY IN INDUSTRIAL RADIOGRAPHY WITH RADIOISOTOPES. P. M. Frazier, C. R. Buchanan, and G. W. Morgan. Nov. 1954. 21p.

Fundamentals of radiation safety are discussed which are applicable to industrial radiography using such radioactive materials as Co^{60}, Ir^{192}, Cs^{137}, and radium. (C.H.)

2590 RM-1285-1(RAND)
RAND Corp.
EFFECTS OF ENVIRONMENT IN REDUCING DOSE RATES PRODUCED BY RADIOACTIVE FALLOUT FROM NUCLEAR EXPLOSIONS. J. E. Hill. Sept. 28, 1954. 10p.

Factors by which the infinite plane dose rate of fission product γ radiation resulting from an atomic explosion would be reduced in various situations are summarized. Reduction rates were calculated for dose rates in open fields, parks, streets of built-up urban areas, and various types of buildings and shelters. Locations offering maximum protection against γ radiation for a civilian population are discussed briefly. (C.H.)

2591 USNRDL-TR-28
Naval Radiological Defense Lab.
CORTISONE AND X IRRADIATION IN RATS. F. T. Brayer, R. J. Holloway, and G. F. Leong. Jan. 14, 1955. 11p.

A relationship was sought between the level of available corticosteroid in rats and their median survival time (MST) when exposed to 720 r x irradiation. Physiological doses of cortisone increased the MST in adrenalectomized, irradiated rats but had no such effect in intact, irradiated rats. Nonphysiological doses of cortisone decreased the MST in both adrenalectomized, irradiated and intact, irradiated rats. (auth)

2592
THE EFFECTS OF OXYGEN ON THE FREQUENCY OF X-RAY-INDUCED MUTATIONS IN HABROBRACON EGGS. Anna R. Whiting (Univ. of Pennsylvania, Philadelphia and Oak Ridge National Lab., Tenn.). Genetics 39, 851-8(1954) Nov.

Metaphase I eggs of Habrobracon were exposed to x rays in atmospheres of air and of nitrogen, the latter administered only during the period of irradiation. Dominant embryo lethals, recessive embryo and postembryo lethals, and visible mutations were recorded. The fact that all types were reduced at the same relative frequency in nitrogen, 500 r in air producing almost identical percentages of mutations as 1100 r in nitrogen, afford, in the opinion of the author, some evidence in favor of the conclusion that reduction in oxygen concentration reduces primary breaks and that other factors influencing final conditions are unchanged in the irradiated cell. (auth)

2593
RELATION OF CARBON DIOXIDE, OXYGEN, AND LOW TEMPERATURE TO THE INJURY AND CYTOGENETIC EFFECTS OF X-RAYS IN BARLEY. R. A. Nilan (State Coll. of Washington, Pullman). Genetics 39, 943-53(1954) Nov.

X raying dormant barley seeds at 15,000 r resulted in a virtually constant mutation rate whether the seeds were irradiated in air, oxygen, or carbon dioxide, at moderate temperatures. The rate of induced injury was reduced by the low temperature but not affected by the gases. The frequency of gross chromosomal aberrations was, however, strikingly altered by both low temperature and the gases. The lack of correlation between chromosomal-aberration and mutation frequencies was interpreted as showing that the gases and temperatures used were ineffectual with regard to primary x-ray damage, but profoundly affected the reunion of broken chromosome ends. The action of oxygen and carbon dioxide at room temperature increased the chromosomal translocation frequencies. However, low temperature, alone or in combination with either of the gases, reduced the interchange frequencies. The increased x-ray tolerance of dormant seeds on solid carbon dioxide reported by Tascher (1929) and Stadler (1931) was confirmed, as was their conclusion that the increased tolerance was due to the low temperature rather than to the presence of gaseous carbon dioxide. (auth)

2594
THE RADIATION RECOVERY FACTOR: PRESERVATION BY THE POLGE-SMITH-PARKES TECHNIQUE. David W. H. Barnes and John F. Loutit (Atomic Energy Research Establishment, Harwell, Berks, England). J. Natl. Cancer Inst. 15, 901-5(1955) Feb.

Spleens of infant CBA mice, when injected intravenously as a mush, can lead to recovery of homologous adult mice given an otherwise lethal dose of x rays. The recovery factor has not been lost when the infant spleens have been stored in glycerol serum at −70°C for as long as 83 days. (auth)

2595
SOME NEW EXPERIMENTS ON PROTECTION AGAINST WHOLE-BODY IRRADIATION. A. Lacassagne, J. F. Duplan, and N. P. BuuHoi (Laboratoire Pasteur de l'Institut du Radium, Paris, France). J. Natl. Cancer Inst. 15, 915-21 (1955) Feb.

The results of experiments on mice and rats receiving whole-body lethal doses of x rays are given. The protective effect of certain chemicals has been studied. An effective diminution of mortality and a prolonged survival time have been obtained with phenolic and naphtholic derivatives containing long chain fatty acids. If the injection takes place more than one hour before irradiation these chemicals afford no protection. Glucosamine administered a few minutes before irradiation also provides some degree of protection for the animals. Survival of rats receiving whole-body irradiation is increased by post-irradiation intravenous injection of an emulsion of liver cells from fetal rats. (auth)

2596
SOME BIOLOGICAL ASPECTS OF THE FACTOR IN BONE MARROW RESPONSIBLE FOR HEMATOPOIETIC RECOVERY FOLLOWING SYSTEMIC IRRADIATION. Mary B. Brown, Barbara B. Hirsch, C. Susan Nagareda, Sarah K. Hochstetler, William G. Faraghan, Paul Toch, and Henry S. Kaplan (Stanford Univ. School of Medicine, San Francisco, Calif.). J. Natl. Cancer Inst. 15, 949-73(1955) Feb.

2597
THE TIME FACTOR IN INHIBITION OF LYMPHOID-TUMOR DEVELOPMENT BY INJECTION OF MARROW CELL SUSPENSIONS INTO IRRADIATED C57BL MICE. Henry S. Kaplan, Lincoln E. Moses, Mary B. Brown, C. Susan Nagareda, and Barbara B. Hirach (Stanford Univ. School of Medicine, San Francisco, Calif.). J. Natl. Cancer Inst. 15, 975-9(1955) Feb.

Groups of strain C57BL mice were given periodic total-body irradiation and injected intravenously with homologous bone-marrow cell suspensions at graded intervals of time thereafter. Lymphoid-tumor incidence was inhibited maximally under these conditions when injection was carried out within 1.5 hours after the last x-ray dose. Inhibition decreased in linear relation to log delay time and was essen-

tially completely lost after a delay of about 16 days. It is inferred that the time when the potentiality of lymphoid-tumor development becomes irreversible in a population of irradiated animals is similarly statistically distributed, and it is suggested that the time required for the injected marrow to exert its inhibitory action, though unknown, is more likely of the order of minutes or perhaps a few hours rather than a matter of days or many hours. Of auxiliary interest is the distinct sex difference in susceptibility revealed under the conditions of this experiment. Females developed more tumors than males at all delay intervals studied, or viewed differently, they would require earlier marrow injection than males for equal tumor incidence, the difference being about 1.37 steps where a step denotes a doubling of the delay. (auth)

2598

PROTECTION OF MICE AGAINST X IRRADIATION BY PLASMA PROTEINS. Agnes N. Stroud, Austin M. Brues, and Mildred M. Summers (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 15, 1109-23(1955) Feb.

Intravenous administration of serum or plasma, homologous or heterologous, or of plasma proteins to mice a few minutes before irradiation afford partial protection against death and other radiation effects. With the exception that no protection against cataracts is apparent, the survival pattern and pathologic changes of protected animals correspond to those of animals given lower radiation dosage. It has not been possible to reduce the mortality after 800 r below that of unprotected mice after 550 r. Using fractionated-plasma proteins it is found that albumin is entirely inactive; the greater part of the activity is found in fractions II and III of Cohn. It appears not to be identical with immune γ globulin and has not been identified with any major electrophoretic component. The effect cannot be explained on the basis of the sulfhydryl content of plasma proteins, nor by blood volume changes resulting from injection. Evidence has been presented which makes it appear doubtful that shock or an anoxic state induced by injection is primarily responsible for the protective action. Additivity of an apparently saturated response with that of cysteine suggests that the action takes place through a different pathway from cysteine action. None of the materials examined has any effect on radiation mortality if administered immediately after irradiation. Perfusion of White's medium through a dog spleen which has been shielded while the dog was given a lethal dose of total-body X radiation yields a material in the perfusate with similar action; perfusion of a normal dog spleen with the same medium fails to do so. (auth)

2599

THE PROTECTIVE EFFECT OF CARBON MONOXIDE AND OTHER GASES ON MICE IRRADIATED IN TOTO BY X RADIATION. P. Bonet-Maury and F. Patti. J. radiol. et electrol. 35, No. 11-12, 851-3(1954). (In French)

Protection against x radiation effects in a group of mice was indicated when the animals were irradiated after the introduction of CO, H_2S, and KCN to their environment. The effect was evident up to those gas concentrations which would normally be lethal, and it is postulated that the protective mechanism is similar to previously noted radiation protection effects accompanying O_2 deficiencies. (K.S.)

2600

STUDIES ON THE NATURE OF THE RADIATION PROTECTION FACTOR IN MOUSE SPLEEN. L. J. Cole, M. C. Fishler, and M. E. Ellis (U. S. Naval Radiological Defense Division, San Francisco, Calif.). Radiology 64, 201-9(1955) Feb.

Results in previous studies on the protective effect of spleen and other tissue homogenates against radiation injuries are reviewed. Data are presented on studies of the post-protection afforded irradiated mice by spleen homogenates from phenylhydrazine-treated mice. On the basis of results presented, it is concluded that the protective factor in the spleens of young mice is a non-dialyzable, unstable, heat-labile, radiosensitive substance associated with the nuclear fraction. (C.H.)

2601

THE MECHANISM OF THE PROTECTIVE EFFECTS OF CYSTEINE. D. Hofmann, R. K. Kepp, G. Oehlert, and H. W. Vasterling. Strahlentherapie 96, 1-13(1955) Jan. (In German)

The effect produced by ionizing radiations in biological tissues is attributable, in a complex fashion, to a number of elementary processes, such as the effects of the hit, the indirect radiation and the far-reaching indirect radiation as well as to a great number of processes of higher order all of which are becoming manifest in the general effect of the radiation. Starting from this fact, the author studied the question whether the protective effect against radiolesions produced by cysteine is due to its action one one, several or all of the above mentioned processes. From the extensive available literature and from the results of numerous of his own investigations, the author concludes that the mode of action of cysteine is of the same complex nature as that of the radiation. Nothing can as yet be said about the necessary qualification for an application of cysteine in the radiotherapy of malignant tumors, namely about a favorable tumor selectivity of the crysteine effect. (auth)

2602

ERYTHEMA INHIBITION BY MEANS OF AMINO ACIDS. H. Theismann. Strahlentherapie 96, 107-10(1955) Jan. (In German)

The author describes two possibilities of inhibiting the formation of radioinduced erythema by means of amino acids. (auth)

RADIOTHERAPY

2603

THE DIPHASIC CHARACTER OF THYROIDAL I^{131} CLEARANCE. John H. Nodine, William H. Perioff, Danilo De Albuquerque, Leon Perczek, and Bertram Channick (Temple Univ. School of Medicine and Philadelphia General Hospital, Philadelphia, Penna.). J. Clin. Endocrinol. and Metabolism 15, 347-53(1955) Mar.

The occurrence of a biphasic thyroidal radioiodide clearance in which the second phase is slower than the first phase, has been observed in 13 of 15 normal subjects. This shift in clearance rate has been correlated with changes in the rates of serum I^{131} disappearance and urinary I^{131} excretion. An apparatus has been constructed and tested, for use in correlating these findings with an initial phase of equilibrium and a final phase of hormonal synthesis. (auth)

2604

COLLOIDAL GOLD INFUSION UNIT. S. Allan Lough (Francis Delafield Hospital, New York). Nucleonics 13, No. 2, 62-4(1955) Feb.

A unit for administering radiogold to patients is described. The unit has the following advantages: it permits

easy transport of the shielded gold bottle; it can be easily moved within the hospital; patients can be treated consecutively by changing only the gold bottle; and technicians are well protected against radiation. (M.P.G.)

2605

DETERMINATION OF DISTRIBUTION OF GAMMA RAYS IN ORGANISMS. H. G. Mehl. Strahlentherapie 96, 124-32 (1955) Jan. (In German)

The course of the isointensity curves over the entire body of a patient treated with 100 mc I^{131} for cancer of the thyroid gland was registered. The measurements were recorded over a period of two weeks following the administration. The intensity values are interpreted and evaluated from the viewpoint of physics. (auth)

TOXICOLOGY STUDIES

2606

TOXICITY TESTS OF DECABORANE FOR LABORATORY ANIMALS. I. ACUTE TOXICITY STUDIES. J. L. Svirbely (Univ. of Pittsburgh, Penna.). Arch. Ind. Health 11, 132-7 (1955) Feb.

Results are reported from studies of the acute toxicity of decaborane for laboratory animals. The decaborane was administered by intraperitoneal injections, oral administration, and percutaneous application. LD_{50} values are presented for mice, rats, and rabbits. (C.H.)

2607

TOXICITY TESTS OF DECABORANE FOR LABORATORY ANIMALS. II. EFFECT OF REPEATED DOSES. J. L. Svirbely (Univ. of Pittsburgh, Penna.). Arch. Ind. Health 11, 138-41(1955) Feb.

Results are reported from studies of the cumulative effects of repetitive small doses of decaborane in laboratory animals. The decaborane was administered by intraperitoneal injection, oral administration, and percutaneous application. (C.H.)

TRACER APPLICATIONS

2608 UCRL-2828

Radiation Lab., Univ. of Calif., Berkeley

INCORPORATION OF ADENINE-4, 6-C^{14} INTO ACID-SOLUBLE NUCLEOTIDES IN THE C_{57} MOUSE. Edward L. Bennett and Barbara J. Krueckel. Jan. 13, 1955. 16p. Contract W-7405-eng-48.

Adenine-4, 6-C^{14} has been administered to male C_{57} mice, and the distribution of the radioactivity has been studied at short time intervals after administration, particularly in the cold TCA-soluble fraction. It has been shown that adenine is rapidly incorporated into the nucleotides of tissue, including 5'-adenylic acid, adenosine diphosphate, adenosine triphosphate, the corresponding guanylic acid derivatives, dephosphopyridine nucleotide, inosinic acid, and possibly TPN. The adenine is rapidly equilibrated between AMP, ADP, and ATP, and is less rapidly incorporated into DPN. The specific activity of the guanine nucleotides is always considerably less than that of the adenine nucleotides. Evidence is presented that the TCA-soluble fraction serves as a precursor for RNA and DNA. (auth)

2609 UCRL-2860

Radiation Lab., Univ. of Calif., Berkeley

THE MEASUREMENT OF LIVER CIRCULATION BY MEANS OF THE COLLOID DISAPPEARANCE RATE. II. CHANGES IN LIVER BLOOD FLOW PRODUCED BY FEEDING, EPINEPHRINE ADMINISTRATION, AND CHRONIC LYMPHATIC LEUKEMIA. George F. Warner, Ernest L. Dobson, Muriel E. Johnston, and Caroline R. Finney. Feb. 4, 1955. 12p. Contracts W-7405-eng-48 and N7onr-295/4.

Human liver blood flow has been measured by the colloid disappearance rate method in one pathological and in two experimental conditions. The eating of a light meal always produced an increase in blood blow, while the administration of epinephrine produced quite variable results. The degree but not the direction of this variability was proportional to the dose of epinephrine. Increased splanchnic blood flow was observed in chronic lymphatic leukemia and was correlated with spleen size. (auth)

2610

LACK OF EFFECT OF FLUORINE INGESTION ON UPTAKE OF IODINE^{131} BY THE THYROID GLAND. J. Elliot Levi and Hannah E. Silberstein (Sinai Hospital, Baltimore, Md.). J. Lab. Clin. Med. 45, 348-51(1955) Mar.

There are historical reasons to suspect that there may be a competitive relationship between fluorine and iodine in the metabolism of the thyroid gland. The iodide-trapping function of the thyroid as measured by radioiodine studies has proved to be an exceedingly sensitive test of one thyroid function and of the relationship of interfering substances such as thiocyanate. However, in seventeen euthyroid subjects, no effect on iodide trapping was demonstrated by the daily administration of 4 mg of fluoride ion in the form of sodium fluosilicate over a ten-week period. Therefore, a dilute solution of fluoride in drinking water of the order of 1 ppm has no effect on radioiodine uptake studies of thyroid function. (auth)

2611

EXPERIMENTS ON THE DISPOSITION OF ACUTELY INHALED $C^{14}O_2$. Austin M. Brues and Agnes N. Stroud (Argonne National Lab., Lemont, Ill.). J. Natl. Cancer Inst. 15, 1071-6(1955) Feb.

Clearance of $C^{14}O_2$ from air into the blood of rats and mice proceeds with almost theoretical efficiency. Calculated rates of passage of alveolar CO_2 into the blood are 24 μM per minute in the mouse and 160 μM per minute in the rat. Uptake of C^{14} is essentially unaffected by the CO_2 concentration of inhaled air. Passage of C^{14} from the bicarbonate compartments into inner compartments proceeds at a somewhat slower rate: 10 μM per minute in the mouse and 80 μM per minute in the rat. At the end of a 45-minute exposure, the specific activity of venous blood is 55 to 60 percent that of alveolar air. After a 45-minute exposure, one half of the absorbed C^{14} in the mouse and one third in the rat, have passed through the bicarbonate pool into inner compartments. These include bone carbonate and both alcohol-soluble and alcohol-insoluble organic compounds in tissue. (auth)

CHEMISTRY

2612 AD-36889

Ionosphere Research Lab., Penna. State Univ.

THE PHOTOCHEMISTRY OF OXYGEN. SCIENTIFIC REPORT NO. 61. Marcel Nicolet. Apr. 15, 1954. 68p. Contract AF19(122)-44.

The aeronomic problem of the dissociation of oxygen is studied quantitatively in the mesosphere and thermosphere. The rate coefficients for various reactions are calculated, and concentrations of ozone and molecular and atomic oxygen are deduced. The way in which departures from photochemical conditions may behave and the differences between day and night time conditions are described. 35 references. (auth)

2613 CCC-1024-TR-90

Connecticut Univ.

ELECTROCHEMISTRY OF BORON COMPOUNDS IN FUSED SALT SOLVENT SYSTEMS. W. C. Orr, A. L. McClelland, E. P. Parry, R. H. Moss, E. A. Healy, and R. M. Valletta. Jan. 21, 1955. 61p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

A study of the electrochemistry of boron compounds in fused salt solvent systems has been initiated with low-melting mixtures of aluminum chloride as the solvent. The behavior of various types of boron compounds in this system has been investigated, and experiments directed toward an understanding of the solvent system itself have been made. Sodium tetraborate, representative of oxygen containing boron compounds, was found to react with an $AlCl_3$–NaCl melt without affecting its decomposition potential. Experimental results indicate that the initial reaction yields solid boric oxide, which is then slowly converted into a soluble boron oxychloride. After many hours the boron is finally expelled from the solution as a volatile compound, presumably BCl_3. Oxygen from the borate is retained in the melt as aluminum oxychloride. Sodium tetraphenylborate was found to react with aluminum chloride to give a reddish-brown product, which may be a phenylchloroaluminate complex, and triphenylborane. Sodium borohydride reacts with $AlCl_3$–NaCl melts in the presence of air to give a volatile, explosive product which may be aluminum borohydride. The phase diagram of the $AlCl_3$–NaCl system has been redetermined in the composition range above 50 mole % $AlCl_3$. An attempt, which has not as yet yielded satisfactory results, has been made to measure the self-diffusion of sodium in the system. The specific conductance at various concentrations and temperatures has been measured for the $AlCl_3$–NaCl system, and also for $AlCl_3$ with other alkali metal halides. The results indicate that the melt consists most probably of sodium ions, Na^+, and chloroaluminate ions, $AlCl_4^-$, associated to a large extent in ion pairs and triple-ions. It is the positive ions that are chiefly responsible for the conductance. (auth)

2614 MCC-1023-TR-98

Buffalo Univ.

INVESTIGATION OF HYDROGEN FLUORIDE AS A SOLVENT FOR SODIUM FLUORIDE AND FOR SODIUM FLUOBORATE. H. Tieckelmann, J. A. Mattern, W. Garner, and C. T. Amborski. June 30, 1954. 14p. [For Olin Mathieson Chemical Corp. Contract NOa(s)52-1023-c].

Thermal analysis points to the existence of NaF·4HF and NaF·3HF. Indications are that the latter of these exists in two forms which have been designated alpha-NaF·3HF and beta-NaF·3HF. No compound formation has been observed in $NaBF_4$–HF solutions. (auth)

2615 MCC-1023-TR-99

Buffalo Univ.

THE BEHAVIOR OF SODIUM BOROHYDRIDE AND BORON TRIFLUORIDE IN THE LOWER ALIPHATIC AMIDES. H. Tieckelmann, J. A. Mattern, and W. Garner. June 30, 1954. 13p. [For Olin Mathieson Chemical Corp. Contract NOa (s) 52-1023-c].

Sodium borohydride forms addition compounds with amides at room temperature. Sodium borohydride and dimethylformamide form a white crystalline hygroscopic material, $NaBH_4 \cdot 3CHON(CH_3)_2$, which melts at 29°C. Sodium borohydride in this solvent retains its reducing power as evidenced by hydrogen evolution and reduction of aldehydes. The solubility is 24 g of sodium borohydride per 100 g of dimethylformamide at 25°C. When the above solution is heated to over 100°C a violent and uncontrollable reaction occurs leading to the formation of trimethylamine. Lewis acids react vigorously with solutions of sodium borohydride in dimethylformamide. Acetamide forms an addition compound with sodium borohydride which melts at about 100°C. Dimethylenetriamine, triethylenetetramine, and tetraethylpentamine each dissolve about 10% by weight of sodium borohydride. Triethylenetetramine and sodium borohydride form a white solid which melts at 85°C. Dimethylformamide-boron trifluoride, previously prepared from tetrahydrofuran-boron trifluoride, has been prepared from boron trifluoride etherate. Dimethylformamide-boron trifluoride is reduced exothermally by sodium borohydride at room temperature. Trimethylamine–boron trifluoride has been isolated as a product. Addition compounds of other amides have been prepared and their properties are being investigated. (auth)

2616 AEC-tr-2081

THE VALUE OF THE STANDARD POTENTIAL OF THE Ni–$Ni(OH)_4$ COUPLE AND THE PROPERTIES OF THE HYDROPEROXIDE OF NICKEL. S. I. Sobol'. Translated from Zhur. Fiz. Khim. 26, 862-5(1952). 8p.

On the basis of new thermodynamic and electrochemical data published in the literature the last two to four years, a computation has been made of the normal oxidation-reduction potential of the ion couple of bivalent nickel–nickel peroxide; the new value equals -1.93 v instead of -1.75 v as computed by Latimer. A proposition is advanced concerning the mechanism of the decomposition of nickel hydroperoxide and the formation of a solid solution of $Ni(OH)_2$ in $Ni(OH)_4$. (auth)

2617 AEC-tr-2087

KINETICS OF THE REDUCTION OF NICKEL OXIDE WITH HYDROGEN. K. Hauffe and A. Rahmel. Translated from Z. physik. Chem. (Frankfurt) (N. F.) 1, 104-28(1954). 14p. Available from Associated Technical Services (Trans. 96G4G), East Orange, N. J.

The relationships between the rate of reduction and the induction period and the partial pressure of hydrogen and water vapor, and the influence of "pretreatment" and of addition of oxides of higher and lower valency were investigated for NiO. In addition, electrical conductivity measurements were used to indicate the time at which Ni nuclei are formed in sintered objects made of NiO. The experimental results were discussed from the point of view of the Wagner-Schottky theory of disarrangement and the edge layer theory of chemisorption developed by Engell and Hauffe. The most significant results found was that the duration of the induction period for NiO and mixtures of NiO and Cr_2O_3 is largely determined by the decrease in the nickel ion vacancy concentration within regions close to the surface. The metal nuclei formed at the end of the induction period probably grow largely along the surface. There is no spatial separa-

tion of the reagents during the further course of the reaction, since the water vapor formed "tears open" the nickel film. Consequently the speed of reduction is not determined by diffusion processes, but by the speed of the reaction at the interface. (auth)

2618 TT-506

ON THE HYDROLYSIS VELOCITY OF PYROPHOSPHATE, TRIPOLYPHOSPHATE AND HEXAMETAPHOSPHATE. FOURTH REPORT ON THE SUBJECT OF POLYMER PHOSPHATES. (Über Die Hydrolysegeschwindigkeit Von Pyrophosphat, Tripolyphosphat Und Hexametaphosphat. Zur Kenntnis Polymerer Phosphate 4. Mittelung). R. Watzel. Translated by D. A. Sinclair from Die Chemie 55, 356-9(1942). 15p.

2619

AN X-RAY DIFFRACTION STUDY TO DETERMINE THE EFFECT OF THE METHOD OF PREPARATION UPON THE CRYSTAL STRUCTURE OF TiO_2. Seppo Wilska (Univ. of Illinois, Urbana). Acta Chem. Scand. 8, No. 10, 1796-1801 (1954)

The existence of different polymorphic forms of hydrolytically prepared TiO_2 is reviewed briefly. A quantitative x-ray diffraction technique by means of a recording spectrometer for determination of rutile and anatase in mixtures of the two is described. Precipitation, drying, and calcination of TiO_2 samples were carried out under varying conditions. Both sulfate and chloride solutions of titanium were used, and the products were examined by x-ray diffraction. It was observed that the initial partially dehydrated product always was amorphous, even after drying at 110°C in practically all cases. At elevated temperatures the first crystalline form of samples originating from sulfate solutions always was anatase. Direct boiling of chloride solutions produced rutile as initial crystalline product, other methods of hydrolysis resulted either in anatase or in mixtures of the two. All samples from both sulfate and chloride solutions were converted into rutile at last between 700 and 920°C, the rate of conversion being somewhat depending on the origin of the sample. No brookite was found at any step. (auth)

2620

STUDIES ON THE HYDROLYSIS OF METAL IONS. X. THE HYDROLYSIS OF THE URANYL ION, UO_2^{2+}. Sten Ahrland, Sirkka Hietanen, and Lars Gunnar Sillén (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 8, No. 10, 1907-16(1954).

Mathematical methods previously described for dealing with polynuclear complexes and applied to the hydrolysis of a number of ions are applied to the data for UO_2^{2+} to throw light on the mechanism of its hydrolysis. (L.M.T.)

2621

STUDIES ON THE HYDROLYSIS OF METAL IONS. XI. THE ALUMINIUM ION, Al^{3+}. Cyrill Brosset, George Biedermann, and Lars Gunnar Sillén (Royal Inst. of Tech., Stockholm, Sweden). Acta Chem. Scand. 8, No. 10, 1917-26 (1954).

Brossets data (Acta. Chem. Scand. 8, 910(1952)) on the hydrolysis of Al^{3+} have been recalculated, using the general methods for treating polynuclear equilibria that have recently been published. (L.M.T.)

2622

DETERMINATION OF SPECIFIC SURFACE OF SIEVE-SIZE POWDERS. Bernard Dubrow and Mary Nieradka (Pyrotechnics Chemical Lab., Dover, N. J.). Anal. Chem. 27, 302-5(1955) Feb.

Instruments available for measurement of specific surface by air permeability have been generally utilized for materials in the subsieve range. This work extends the range of air permeability measurements to sieve-size powders. An instrument which employs a sensitive adjustable flowmeter was developed. The accuracy and precision of the method indicate that the instrument can readily be adopted for rapid routine measurements of specific surface or average particle size in the range investigated. (auth)

2623

THE BEHAVIOR OF THE SILVER, SILVER CHLORIDE AND THE MERCURY, MERCUROUS CHLORIDE ELECTRODES AT HIGH TEMPERATURES. M. H. Lietzke and J. V. Vaughen (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 876-8(1955) Feb. 20.

In continuing the development of a high-temperature reference electrode a series of measurements of the potential of the silver, silver chloride and the mercury, mercurous chloride electrode combination in hydrochloric acid has been made. The temperature was varied from 25 to 263° and the acid concentration from 0.01 to 1.0M. The potentials obtained at given temperatures were compared with those predicted on the basis of thermodynamic caiculations for this cell combination. Evidence for hydrolytic decomposition of calomel at low acid concentrations and high temperatures has been found. (auth)

2624

THE KINETICS OF COORDINATE BOND FORMATION. II. G. B. Kistiakowsky and R. Williams (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 23, 334-8(1955) Feb.

The technique of temperature pattern determination, shown previously to be suitable for the measurement of fast gaseous reactions, has been extended to reactions of boron tirfluoride with ammonia, dimethylamine, n-butylamine, t-butylamine, and pyridine. The bimolecular rate constants of the first two of these show pressure dependence; those of the other three, within experimental error, do not. A comparison with the previously obtained results on methylamine and trimethylamine demonstrates that the lifetime of the "hot" quasi-molecules formed by the addition of boron trifluoride and an amine increases regularly with the number of vibrational degrees of freedom of the quasi molecule. The rates of addition are all substantially smaller than the rate of recombination of methyl radicals. They increase by about a factor of thirty from that of ammonia to those of heavier amines, being then about 1/30 of the collisional frequency. This finding is not consistent with the supposition that steric requirements alone limit the rates of addition and the existence of a small activation energy is clearly suggested, although it could not be observed experimentally. To explain the present results, the activation energy must decrease from ammonia to heavier amines. Such a decrease is found to be consistent with the presently accepted views on the electronic structure of the boron-nitrogen bond. (auth)

2625

ELECTRONIC CONFIGURATION IN ELECTRODEPOSITION FROM AQUEOUS SOLUTION. III. METAL DEPOSITION FROM CERTAIN COMPLEX IONS. Ernest H. Lyons, Jr., John C. Bailar, Jr., and H. A. Laitinen (Univ. of Illinois, Urbana). J. Electrochem. Soc. 101, 410-14(1954) Aug.

The cathodic behavior of cobalt, nickel, copper, and zinc

complexes of 8-hydroxyquinoline-5-sulfonic acid, 1, 10-phenanthroline, glycine, 1, 2- and 1, 8-naphthalenediamines, tetramethylethylenediamine, and dimethylglyoxime was investigated by determining cathode current efficiencies and polarograms. Deposition was not obtained from ions believed to have hybridized orbitals which involve the penultimate electron shell, that is, from the "inner orbital" complexes of Taube. Deposits were obtained from "outer orbital" ions, thus confirming the rule previously proposed. Evidence is given that copper, as well as cobalt and nickel, forms both types of ions. (auth)

2626

THERMODYNAMIC PROPERTIES OF THE TITANIUM CHLORIDES. Gordon B. Skinner and Robert A. Ruehrwein (Monsanto Chemical Co., Dayton, Ohio). J. Phys. Chem. 59, 113-17(1955) Feb.

The heat of formation at 25° of liquid titanium tetrachloride has been found to be -191 ± 3 kcal/mole, and that of solid titanium trichloride, -170.0 ± 0.8 kcal/mole. Experimental determinations have been made of the total disproportionation pressures of titanium trichloride and dichloride, the vapor pressure of titanium trichloride, and the molecular weight of titanium trichloride. Equilibria in the reactions between titanium tetrachloride vapor and titanium carbide, and between sodium chloride and titanium metal, were also investigated. Some estimates of thermal functions of the titanium chlorides were made to permit thermodynamic calculations relating the various experiments. (auth)

2627

VAPORIZATION OF INORGANIC SUBSTANCES: B_2O_3, TeO_2, AND Mg_3N_2. John R. Soulen, Prasom Sthapitanonda, and John L. Margrave (Univ. of Wisconsin, Madison). J. Phys. Chem. 59, 132-6(1955) Feb.

The necessity for auxiliary experiments in the study of vaporization of substances at high temperatures is discussed. Earlier work pertaining to the vaporization of B_2O_3 and TeO_2 is reviewed, and new vapor pressure determinations are presented which extend the temperature ranges of the measurements. In the temperature ranges studied B_2O_3 and TeO_2 are found to vaporize as $B_2O_3(g)$ and $TeO_2(g)$ molecules, and vapor pressure equations are given. ΔH_0^0 of sublimation has been calculated from vapor pressure data for B_2O_3 with the aid of free energy functions, and the heats of sublimation, vaporization and fusion are given for TeO_2. Vapor pressure measurements have been supplemented by spectroscopic observations, and bands attributable to the $B_2O_2(g)$ molecule have been found. The vaporization of Mg_3N_2 has also been studied and found to be more complex. It is found that the $Mg_2(g)$ molecule is involved in the process of vaporization of Mg_3N_2. From the $Mg_2(g)$ band spectrum the dissociation energy of the molecule has been estimated. Final products of Mg_3N_2 vaporization are Mg(g) and $N_2(g)$. (auth)

2628

THE DISPROPORTIONATION AND VAPOR PRESSURE OF $TiCl_3$. Milton Farber and A. J. Darnell (California Inst. of Tech., Pasadena). J. Phys. Chem. 59, 156-9(1955) Feb.

The heat of reaction for the disproportionation of $TiCl_3(s)$ into $TiCl_4(g)$ and $TiCl_2(s)$ and also the vapor pressure and heat of sublimation of $TiCl_3$ have been determined by means of a molybdenum effusion cell. The temperature range of the effusion experiments was 600 to 740°K. A value of 38 ± 1 kcal/mole at 298°K was obtained for the heat of reaction for the disproportionation of $TiCl_3$. The heat of sublimation of $TiCl_3$ was found to be 42 ± 1 kcal/mole at 298°K from which an approximate boiling point of 1200°K was estimated for $TiCl_3$. The entropy of reaction for the disproportionation of $TiCl_3$ was calculated as 38 eu at 298°K while the entropy of sublimation of $TiCl_3$ was 37 eu at 298°K. The partial pressures of $TiCl_4$ resulting from the disproportionation of $TiCl_3$ range from 0.005 mm at 636°K to 0.200 mm at 732°K, while the vapor pressure of $TiCl_3$ varies from 0.0002 to 0.010 mm over the same temperature range. (auth)

2629

MIXED SUBSTITUTED COMPOUNDS IN THE SERIES BORON TRICHLORIDE–BORON TRIBROMIDE AND THEIR VIBRATION SPECTRA. J. Goubeau, D. E. Richter, and H. J. Becher. Z. anorg. u. allgem. Chem. 278, 12-23(1955) Jan. (In German)

In a mixture of BCl_3 and BBr_3, the mixed compounds BCl_2Br and BBr_2Cl were identified by Raman and infrared spectra. The quantitative analysis of a single spectrum, under simplified hypothesis, places the equilibrium constant of the reaction $BCl_3 + BBr_3 \rightleftharpoons BCl_2Br + BBr_2Cl$ in liquid phase. (tr-auth)

2630

PREPARATION OF ANHYDROUS TITANIUM CHLORIDE. Viktor Gutmann, Hans Nowotny, and Gerhard Ofner. Z. anorg. u. allgem. Chem. 278, 78-81(1955) Jan. (In German)

The preparation of anhydrous $TiCl_2$ by the reduction of $TiCl_4$ with H in electrodeless electric discharge is described. $TiCl_2$ thus obtained is free of Ti metal. (tr-auth)

ANALYTICAL PROCEDURES

2631 AWRE-O-14/54

Atomic Weapons Research Establishment, Aldermaston, Berks (England)

THE DETERMINATION OF TRACES OF OXYGEN IN GASES BY A GALVANIC METHOD. P. Bomyer and Elizabeth C. Hutt. Feb. 22, 1954. 17p.

Traces of oxygen in nitrogen or other gases flowing over the partially immersed anode of a suitably designed electrolytic cell are reduced to the hydroxyl ion, while the cathode is correspondingly oxidized. The galvanic current generated by the system is a function of the oxygen content of the gas. By the use of this principle the oxygen content of nitrogen can be measured from zero to 600 ppm by volume to within 0.5 ppm or 5% whichever is the greater. A brief description of other methods of oxygen measurement is given in the Appendix. (auth)

2632 MR-538

Pitman-Dunn Labs., Frankford Arsenal

COLORIMETRIC DETERMINATION OF SILICON IN TITANIUM ALLOYS. M. Codell, C. Clemency, and G. Norwitz. Feb. 1953. 15p. (AD-7369)

The sample is dissolved in HF, and H_3BO_3 is added to complex the F ion. The Ti is hydrolyzed by heating for 90 min in a boiling water bath. The solution is filtered, and the amount of Si is determined colorimetrically in the filtrate by the Mo blue method. The method is applicable to Ti alloys containing 0.005 to 1.5% Si. The presence of more than 7.5% Fe, 10% Cr, 0.75% Cu, 2% Ni, 2.5% Co, or 0.5% P interfered with the procedure. (ASTIA abst.)

2633 ORNL-1641

Oak Ridge National Lab.

THE SALICYLATE METHOD FOR DETERMINING MICROGRAM AMOUNTS OF URANIUM. Paul F.

Thomason, Leighton A. Nutting, Urpo Koskela, and Ward M. Byerly. Mar. 10, 1955. 17p. Contract W-7405-eng-26.

The spectrophotometric salicylate method for the determination of uranium in solutions was used extensively at the Clinton Laboratories (former name of Oak Ridge National Laboratory) in 1944 and 1945. Although it has been largely replaced by other methods, it is still useful as a rapid method of analysis when the interferences are known. When sodium salicylate is added to uranium in a solution that is buffered to a pH of about 8 with an ammonium acetate-ammonium hydroxide buffer, a yellow color is produced. This color can be measured on the Coleman (or Beckman) spectrophotometer. If the prescribed procedures for the respective ranges are followed, the relative standard deviation of the method is 3% in the range of 50 to 1800 micrograms of uranium and 5% in the range of 5 to 125 micrograms of uranium. (auth)

2634 UCRL-4377

Radiation Lab., Univ. of Calif., Livermore

RADIOCHEMICAL PROCEDURES IN USE AT THE UNIVERSITY OF CALIFORNIA RADIATION LABORATORY (LIVERMORE). Manfred Lindner, comp. Aug. 10, 1954. Decl. Jan. 18, 1955. 46p. Contract W-7405-eng-48.

A systematic compilation of many radiochemical procedures previously not described elsewhere has been made. Although the procedures are generally applicable to starting solutions of various compositions, the present report describes separation and decontamination from fission mixtures of widely varying origin. (auth)

2635 WIN-7

Raw Materials Development Lab., National Lead Co., Inc.

THE SPECTROPHOTOMETRIC DETERMINATION OF PHOSPHORUS AS MOLYBDOVANADOPHOSPHORIC ACID. Kenneth P. Quinlan and Michael A. DeSesa. Feb. 21, 1955. 21p. Contract AT(49-6)-924.

The molybdovanadophosphoric acid method for the spectrophotometric determination of phosphorus has been extensively reviewed. The optimum concentrations of acid, vanadium (V), and molybdenum (VI) were determined by fractorial experiment. The optimum color development occurs in solutions which are 0.4M in acid, 0.02 to 0.06M molybdenum (VI) and 1.0 to 4.0mM vanadium (V). The optimum range is 3 to 20 ppm P_2O_5 for 1 cm cells. Dichromate is the only serious interference, but can be eliminated by volatilization of the chromium as chromyl chloride. (auth)

2636

CONTINUOUS DETECTION AND MEASUREMENT OF LOW CONCENTRATIONS OF OXYGEN IN GASES. Leonard P. Pekowitz (Knolls Atomic Power Lab., Schenectidy, N. Y.). Anal. Chem. 27, 245-8(1955) Feb.

The continuous detection and measurement of low concentrations of oxygen in gases is of paramount importance in liquid metal heat transfer technology. This paper describes an instrument based on the dew point principle for such continuous detection and measurement. A sensitivity of at least 0.0005 volume % of oxygen is attained with a mean deviation for precision of ± 0.0001 volume %. The instrument is applicable to the determination of oxygen in the common gases such as nitrogen, helium, the other rare gases, hydrogen, and carbon dioxide. (auth)

2637

COLORIMETRIC DETERMINATION OF MANGANESE. OXIDATION WITH BROMATE IN SULFURIC ACID MEDIUM. William C. Purdy and David N. Hume (Massachusetts Inst. of Tech., Cambridge). Anal. Chem. 27, 256-8(1955)

A method has been developed for the colorimetric determination of manganese in the centigram range based on the oxidation of manganous ion to a trivalent sulfate complex with bromate in 8M sulfuric acid solution. The bromine color is discharged with cyanide ion. The complex, measured at 500 mμ, obeys Beer's law over the range of 2 to 70 mg of manganese per 100 ml of solution, and the color is stable for one week. Interfering substances are reducing agents, chromic ions, and ions forming insoluble sulfates. The effect of the latter can be removed by filtration. (auth)

2638

MOLYBDENUM BLUE REACTION AND DETERMINATION OF PHOSPHORUS IN WATERS CONTAINING ARSENIC: SILICON, AND GERMANIUM. Harry Levine, J. J. Rowe, and F. S. Grimaldi (U. S. Geological Survey, Washington, D. C.). Anal. Chem. 27, 258-62(1955) Feb.

Microgram amounts of phosphate are usually determined by the molybdenum blue reaction, but this reaction is not specific for phosphorus. The research established the range of conditions under which phosphate, arsenate, silicate, and germanate give the molybdenum blue reaction for differentiating these elements, and developed a method for the determination of phosphate in waters containing up to 10 ppm of the oxides of germanium, arsenic(V), and silicon. With stannous chloride or 1-amino-2-naphthol-4-sulfonic acid as the reducing agent no conditions were found for distinguishing silicate from germanate and phosphate from arsenate. In the recommended procedure the phosphate is concentrated by coprecipitation on aluminum hydroxide, and coprecipitation on aluminum hydroxide, and coprecipitated arsenic, germanium, and silicon are volatilized by a mixture of hydrofluoric, hydrochloric, and hydrobromic acids prior to the determination of phosphate. The total phosphorus content of several samples of sea water from the Gulf of Mexico ranged from 0.018 to 0.059 mg of phosphorus pentoxide per liter of water. (auth)

2639

DETERMINATION OF MICROGRAM QUANTITIES OF STRONTIUM IN SOLUTION. EVALUATION OF FLAME SPECTROPHOTOMETRIC METHOD. Albert E. Taylor and Harold H. Paige (Idaho State Coll., Pocatello). Anal. Chem. 27, 282-4(1955) Feb.

Because of the widespread occurrence of small quantities of strontium, its chemical resemblance to calcium, and its occurrence in the bones of man and animals, there is a need for reliable methods to detect and measure microgram quantities of this element. A study of flame photometric methods, including two different fuels, acetylene and hydrogen, and different light-measuring devices has been carried out. A few interfering elements have been included in the study. A statistical evaluation of the results indicates the general superiority of a photomultiplier detection unit (Photovolt Model 520-M), acetylene as the fuel, and a wave length of 681 mμ with a Beckman Model DU flame photometer attachment. Average standard deviations of 0.5 ppm or less in the range 0 to 10 ppm strontium have been obtained. The method can be readily applied to solutions containing strontium in this range after preliminary experience with the equipment and interferences. (auth)

2640

MODIFIED NITROMETER. B. D. Holt (Argonne National

Lab., Lemont, Ill.). Anal. Chem. 27, 334(1955) Feb.

The gas-measuring assembly of a DuPont nitrometer was replaced by one fabricated from a Fisher Precision Universal gas-measuring unit, substantially decreasing the awkwardness of measuring the nitric oxide gas evolved in the reaction bulb. The buret and the compensating tube are enclosed together in a water jacket to maintain common tube temperatures and are connected only by a Hg manometer, each tube having its own leveling bulb. A 100-ml buret is used which permitted the use of a smaller reaction bulb with a correspondingly smaller Hg load to be handled during the reaction. The reaction bulb was made from a 200-ml gas sampling bulb by replacing one of its two-way stopcocks by a three-way stopcock and a culp. The principle involved in the gas measurement is the same. Methods of standardization and analysis are presented. (J.A.G.)

2641

ESTIMATION OF THORIUM BY ORGANIC REAGENTS. PART III. USE OF 2 : 4-D IN THE SEPARATION OF THORIUM FROM ZIRCONIUM, TITANIUM AND IRON AND THEIR CO-DETERMINATIONS. Sachindra Kumar Datta and Gurupada Banerjee. J. Indian Chem. Soc. 31, 773-8(1954) Oct.

2 : 4-D can separate thorium completely from ferrous iron and titanium in solutions. But as this reagent forms quantitative precipitates of both ferric iron and zirconium, workable methods for their separation and co-determinations with the help of this reagent have been developed. A process for the separation and estimation of iron (ic), zirconium, thorium and titanium, when present in a mixture, has also been delt with. (auth)

2642

ESTIMATION OF THORIUM BY ORGANIC REAGENTS. PART IV. VOLUMETRIC ESTIMATION BY ANTHRANILIC ACID AND GRAVIMETRIC ESTIMATION BY 5-IODO-ANTHRANILIC ACID. Sachindra Kumar Datta and Gurupada Banerjee. J. Indian Chem. Soc. 31, 779-83(1954) Oct.

Using a suitable acid medium, the principle of quantitative bromination of anthranilic acid residues present in the thorium precipitate has been adopted for the volumetric estimation of thorium. Uses of the sodium and ammonium salts of 5-iodo-anthranilic acid for the gravimetric estimation of thorium and its separation from cerite earths are also described. (auth)

2643

HYDROXY-TOLUIC ACID AS A REAGENT FOR THE DETERMINATION OF THORIUM. G. S. Deshmukh (Banaras Hindu Univ., India). Naturwissenschaften 42, 69-70(1955) Feb. (In English)

It found that hydroxy toluic acid is a potential reagent for the precipitation of Th, hence it is possible to separate Th completely from trivalent rare earths and U. (J.E.D.)

2644

POTENTIOMETRIC DETERMINATION OF IRON BY X-RAY OXIDATION. Melvin A. Dewar and Robert R. Hentz (North Carolina State Coll., Raleigh). Nucleonics 13, No. 2, 54-6 (1955) Feb.

The feasibility of using ionizing radiation as a redox reagent in analytical determinations has been investigated. Ferrous solutions were irradiated by x rays. The solutions were continuously stirred during irradiation, and periodic potential measurements were made. By plotting potential vs. irradiation time, potentiometric titration curves were obtained roughly similar to the curves for standard redox titrations. The stoichiometric point was found at the intersection of the extrapolated horizontal and sharply rising parts of the curve. A calibration curve was plotted of irradiation time necessary for complete oxidation (stoichiometric dose) vs. initial ferrous ion concentration of the solution. It should be possible to determine unknown concentrations of ferrous solutions from the calibration curve after the stoichiometric points have been obtained from the titration curves for the solutions. Application of this method to more complex solutions is necessary before its feasibility can be established. (M.P.G.)

2645

MICRO METHOD OF ANALYSIS FOR HEAVY WATER. R. E. Mardaleishvili, G. K. Lavrovskaya, and V. V. Voevodskii (Moscow State Univ.). Zhur. Fiz. Khim. 28, 2195-8(1955) Dec. (In Russian)

A compensation method of measuring vapor tensions for determining the D content of water is described. The D in 0.5 mg of water can be determined with an accuracy of 0.05 to 0.1 mole %. (G.Y.)

DEUTERIUM AND DEUTERIUM COMPOUNDS

2646

HYDROLYSIS OF ALKYL HALIDES AND SULFONIUM SALTS BY LIGHT AND HEAVY WATER. C. Gardner Swain, Robert Cardinaud, and Arthur D. Ketley (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc. 77, 934-6 (1955) Feb. 20.

t-Butyl chloride hydrolyzes 40% faster in light water than in heavy water, whereas t-butyldimethylsulfonium ion and methyl halides hydrolyze at the same rate in the two media. The reaction of methyl halides with pyridine also is unaffected by this solvent change. The significance of these results is discussed. (auth)

2647

QUADRUPOLE COUPLING OF THE DEUTERON IN DCCCl AND DCN. Robert L. White (Columbia Univ., New York). J. Chem. Phys. 23, 253-5(1955) Feb.

The quadrupole coupling of the deuteron $(eqQ)_D$ was measured in DCCCl where it was found to be $+175 \pm 20$ kc/sec. A less accurate determination of the absolute value $(eqQ)_D$ in DCN yielded approximately 290 kc/sec. The field gradient, q, at the deuterium nucleus in DCCl is $+8.85 \pm 10$ percent $\times 10^{14}$ esu. A calculation of q based on a Hund-Muliken molecular model yields a q of the same sign as that observed but approximately twice as large, indicating the insufficiency of the model for such detailed calculations. (auth)

2648

EXCHANGE BETWEEN HEAVY WATER AND CLAY MINERALS. Joseph A. Faucher and Henry C. Thomas (Yale Univ., New Haven, Conn.). J. Phys. Chem. 59, 189-91(1955) Feb.

2649

REGULARITIES IN THE EQUILIBRIUM DISTRIBUTION OF DEUTERIUM IN ISOTOPIC EXCHANGE REACTIONS OF HYDROGEN. Ya. M. Varshavskii and S. E. Vaisberg. (Karpov Physico Chemical Research Inst.). Doklady Akad. Nauk S.S.S.R. 100, 97-100(1955) Jan. 1. (In Russian)

A temperature dependent molecular partition function entering into the expression for the distribution coefficient is

derived and evaluated for 26 hydrides ranging in weight from LiH to CsH. The function shows regularities when plotted against the atomic weight. (G.Y.)

FLUORINE AND FLUORINE COMPOUNDS

2650 AD-42694

Plastics Lab., Princeton Univ.

PERFLUORINATION OF DIMETHYL-SUBSTITUTED FLUORANTHENES. TECHNICAL REPORT NO. 34A. S. Bonotto, G. B. Duhnkrack, and D. S. Trifan. July 19, 1954. 85p. Contract DA-36-039-SC-42633, Report No. 2A.

A modification of existing methods of perfluorinating hydrocarbons over AgF_2 was developed and employed in the perfluorination of dl-cis-1,4-dimethylfluoranthene, dl-cis-1,4-dimethyl-2,3-dihydrofluoranthene, and fluoranthene to obtain a low loss-low K liquid dielectric having a very wide liquid range, etc. Fluorination of the dimethyl derivatives produced a mixture of undegraded and slightly degraded perfluorocarbon. The distillation fractions were examined in detail, including dielectric and infrared spectra analysis. (auth)

2651

VIBRATIONAL SPECTRA OF CYCLOBUTFORENE (HEXAFLUOROCYCLOBUTENE). J. Rud Nielsen and M. Z. El-Sabban (Univ. of Oklahoma, Norman) and Morris Alpert (Naval Research Lab., Washington, D. C.). J. Chem. Phys. 23, 324-8(1955) Feb.

The infrared spectrum of gaseous cyclobutforene has been obtained in the region from 2 to 38μ with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of the liquid phase has been photograhped with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. With some uncertainties, especially as to symmetry species, all of the twenty-four fundamental vibration frequencies have been assigned, and the spectra have been interpreted in detail. (auth)

2652

INFRARED AND RAMAN SPECTRA OF FLUORINATED ETHANES. VIII. PENTAFLUOROETHANE. J. Rud Nielsen and Howard H. Claassen (Univ. of Oklahoma, Norman) and Norma B. Moran (Naval Research Lab., Washington, D. C.). J. Chem. Phys. 23, 329-33(1955) Feb.

The infrared spectrum of gaseous CF_3CF_2H has been observed in the region from 2 to 38μ, and the spectrum of the liquid at −50°C from 2 to 22μ, with the aid of LiF, NaCl, KBr, and KRS-5 prisms. The Raman spectrum of gaseous CF_3CF_2H has been photographed with a three-prism glass spectrograph of linear dispersion 15 A/mm at 4358 A. All but one of the fundamental vibration frequencies have been assigned, and the spectra have been interpreted in detail. (auth)

GRAPHITE

2653

LAYER GROWTH OF ARTIFICIAL GRAPHITE. Takurō Tsuzuku (Tōkai Electrode Mfg. Co., Ltd., Fujisawa-City, Japan) and Tsutomu Komoda (Hitachi Co., Ltd., Kokubunji, Tokyo, Japan). J. Phys. Soc. Japan 10, 81-2(1955) Jan.

Pyramidal layer growth was observed on artifical monocrystals of graphite. Typical patterns shown in electron micrographs suggest concentric loops to be taken as the double-ended spirals expected when two screw dislocations of opposite signs emerge on the crystal surfaces. (auth)

2654

THE RHOMBOHEDRAL MODIFICATION OF GRAPHITE. H. P. Boehm and U. Hofmann. Z. anorg. u. allgem. Chem. 278, 58-77(1955) Jan. (In German)

LABORATORIES AND EQUIPMENT

2655 KAPL-1277

Knolls Atomic Power Lab.

DEVELOPMENT OF A GAS MICROFLOWMETER. W[alter] A. Heywood, C. Mannal, and C[elesta] J. Hibbert. Jan. 25, 1955. 32p. Contract W-31-109-Eng-52.

The development and calibration procedures of a microflowmeter to measure gas flow rates ranging from 0.001 to 20 cc/min (STP) by a bubbling technique are described. Typical calibration curves for hydrogen, helium, nitrogen, argon, carbon dioxide, and methane are included. (auth)

2656

PROPORTIONAL LIQUID SAMPLER. John M. Ruddy (Brookhaven National Lab., Upton, N. Y.). Nucleonics 13, No. 2, 48(1955) Feb.

Design criteria are established for a proportional, gravity-flow, liquid-waste sampler for chemical, biological, and medical laboratories using radioisotopes. The criteria are as follows: accurate foolproof-operation gravity flows between 0 and 10 gpm; rugged simple construction; ease of attendance; self-powered if possible; economical initial cost; maximum flexbility of size and installation; minimum hydraulic gradient loss; ratio of sample to total effluent of 2 cm^3/gal; and 50-gal tank working capacity. A sampler constructed to evaluate these criteria is described. (L.T.W.)

RADIATION CHEMISTRY

2657 AD-17929

Illinois Univ.

STUDIES OF EFFECTS OF HIGH ENERGY RADIATION ON CHEMICAL SYSTEMS. FINAL REPORT [FOR THE PERIOD JUNE 15, 1951 TO SEPTEMBER 30, 1953]. G. L. Clark, P. E. Bierstedt, and J. O. Gardner. 18p. Contract DA 18-108-CML-2446.

Results are summarized from an investigation of a wide range of possible chemical systems sensitive to high-energy radiation. Fundamental and quantitative studies were aimed at the discovery of some system of sufficient sensitivity and reproducibility to warrant practical field tests as a dosimeter. Systems investigated included solids, liquids, aqueous, and non-aqueous solutions. For the most promising system, a mixed alcoholic solution of 2-hydroxy-4-nitrophenylazo-β-naphthol and resazurin, containing carbon tetrachloride as sensitizer, results of field tests of an A-bomb explosion are evaluated. Other chemical systems investigated include mercuric chloride-ammonium oxalate, indole, α-amino acids, leucocyanide of malachite green, metal oxinates and derivatives, iodine-containing compounds, aqueous solutions of several inorganic complex compounds, organic melt-indicator dye systems, organic fluorine compounds, brilliant green, uranyl compounds, substituted benzathiazoline and its derivatives, and non-aqueous systems. Several methods were investigated for detecting hydrogen peroxide produced in water and aqueous solutions upon irradiation. (C.H.)

2658

ALGINIC ACID AS A MODEL FOR TESTING THE EFFECTS

OF RADIOMIMETIC AGENTS. Robert N. Feinstein and Leo L. Nejelski, Jr. (Univ. of Chicago, Ill). Radiation Research 2, 8-14(1955) Feb.

Alginic acid, a hydrophilic colloidal polymer of anhydro-β-D-mannuronic acid units, is a convenient model for the study of radiation and radiomimetic agents, because of its ready availability, behavioral consistency, known chemistry, high viscosity, and radiosensitivity as measured by changes in viscosity. X radiation reduces the viscosity of alginate solutions, whereas sulfur and nitrogen mustards either reduce the viscosity or increase it, even to the point of gelation, depending on the concentration of alginate and of mustard. Fenton's reagent, ferrous salt plus H_2O_2, consistently reduces the viscosity of alginate solutions, the amount of reduction being dependent on the concentrations of ferrous salt and H_2O_2. Ferric salt can replace the ferrous; the action is then greatly delayed, but the same ultimate decrease in viscosity is achieved. If the Fe^{++} and H_2O_2 are premixed before being added to the alginate, the reduction in viscosity is less but still apparent, even after a time lapse of several minutes between premixing and adding to the alginate. (auth)

2659

THE DIRECT ACTION OF FAST CHARGED PARTICLES ON HYALURONIC ACID, HYALURONIDASE, AND A COMBINATION OF THE ENZYME AND SUBSTRATE. Richard Setlow and Barbara Doyle (Yale Univ., New Haven, Conn.). Radiation Research 2, 15-25(1955) Feb.

The ability of hyaluronic acid to produce turbidity in albumin solutions is reduced if the hyaluronic acid is bombarded in the dry state with fast charged particles. The sensitivity of the hyaluronic acid depends on the rate of energy loss of the incident charged particles. The sensitivity at liquid air temperature is about the same as at room temperature. Irradiation data indicate that the hyaluronic acid unit responsible for turbidity production is a long, thin cylinder of diameter about 15 Å. The length of the cylinder depends on the preparation. Testicular hyaluronidase has a molecular weight from radiation data of about 75,000. Hyaluronidase when dried together with hyaluronic acid is more sensitive to the direct action of radiation than when irradiated alone. An ionization in the substrate may inactivate the enzyme. The data indicate that this increased sensitivity depends on the specific combination of enzyme and substrate. Radiation data, not confirmed by sedimentation studies, indicate that the enzyme is altered physically after it has acted on the substrate. (auth)

2660

YIELDS OF HYDROGEN PEROXIDE IN THE DECOMPOSITION OF WATER BY COBALT γ-RADIATION. II. EFFECT OF CHLORIDE ION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). Radiation Research 2, 26-32(1955) Feb.

A comparison is presented of the effect of KCl with that of KBr on the formation of H_2O_2 in air-saturated water subjected to Co^{60} γ-radiation. (C.H.)

2661

RADIATION CHEMISTRY OF AQUEOUS FERROUS SULFATE SOLUTIONS. EFFECT OF γ-RAYS. Edwin J. Hart (Argonne National Lab., Lemont, Ill.). Radiation Research 2, 33-46(1955) Feb.

The mechanism of the aqueous ferrous sulfate-cupric sulfate system was investigated by studying the effect of pH, of ferrous and cupric ion concentrations, and of dissolved oxygen on the yield of the products following exposure to Co^{60} γ radiation. Ferric ions, hydrogen, and oxygen were found to be products of the γ irradiation of air-free aqueous ferrous sulfate-cupric sulfate solutions. An analysis of the dependence of yields of these products on the concentration variables was made, and conclusions are presented regarding the mode of formation of the molecular products. (C.H.)

2662

EFFECT OF IONIZING RADIATION OF LONG-CHAIN OLEFINS AND ACETYLENES. A. Charlesby (Atomic Energy Research Establishment, Harwell, Berks, England). Radiation Research 2, 96-107(1955) Feb.

The irradiation of unsaturated hydrocarbons (olefins and acetylenes) results in crosslinking similar to that observed for the equivalent saturated molecules (paraffins). The presence of the unsaturated bond does not appear to result in any chain reaction, with the exception of ethylene although in this case chain reaction proceeds with far greater difficulty than for other monomers such as styrene and methyl methacrylate. The ease of crosslinking depends on the position of the unsaturated bond. When near the center, the bond behaves very much as a saturated bond in the corresponding paraffin, whereas when it is at the end of the molecules the radiation energy required per crosslink is reduced from 32 ev (for the paraffin) to 19 ev (in the olefin) and 13 ev (in the acetylene). The average energy per crosslink varies little with the length of the irradiated molecule. The presence of two double bonds (in a diene molecule) reduces the energy per crosslink as compared with molecules with only one double bond, but the difference is not great, certainly insufficient to indicate the occurrence of any chain reaction. In addition to crosslinking changes in isomerism of olefins take place under irradiation. Both trans and cis structures are converted to a mixture containing about 35% trans after 10 units of radiation. There is very little change in unsaturation. (auth)

2663

INFLUENCE OF IONS ON THE NUCLEATION PROCESSES IN LIQUIDS. II. LIQUIDS UNDER POSITIVE PRESSURE IN METASTABLE THERMODYNAMICAL EQUILIBRIUM (OVERHEATED LIQUIDS). L. Bertanza and G. Martelli (Univ. of Pisa, Italy). Nuovo cimento (10) 1, 324-36(1955) Feb. (In English)

The behavior of liquids in metastable equilibrium under positive pressure has been investigated, and an expression for the total flux of critical bubbles carrying different number of ions has been found. A comparison between results and the data of some experiments shows that in some cases the contribution of the ions at the nucleation processes in overheated liquids cannot be neglected. The total flux of bubbles is larger than that obtained when the effect of the ions is neglected; therefore the waiting times are shorter and, in some cases, become zero effectively. (auth)

RADIATION EFFECTS

2664

ELECTRICAL AND CHEMICAL EFFECTS OF β-RADIATION IN POLYSTYRENE. Paul Yen-Hsiung Feng and Joseph W. Kennedy (Washington Univ., St. Louis, Mo.). J. Am. Chem. Soc. 77, 847-51(1955) Feb. 20.

Electric conductivity of polystyrene, polyethylene and Teflon under β irradiation has been studied by investigation of the potentials produced by the passage of β rays through the dielectrics. A potential of 60 kv has been produced in a single stage and 88 kv in two stages. The potentials agree

reasonably well with values calculated from the assumptions that the dielectric conductivity is proportional to the concentration of radiation-produced ions and that these ions disappear by bimolecular reaction. Irradiation of polystyrene by β particles is found to cause degradation if air is present but to cause further polymerization of air is excluded. Bombardment of polystyrene in a helium atmosphere by deuterons caused extensive cross linkage. The data obtained in studies of the radiation chemical effects in polystyrene show that the rate of polymerization depends on the square root of the radiation intensity. In the presence of air the rate of degradation varies with something between the square root and the first power of the radiation intensity. (auth)

2665

ABSORPTION SPECTRUM OF $NaNO_3$ EXPOSED TO IONIZING RADIATION. P. Pringsheim (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 369-75(1955) Feb.

The changes produced by ionizing radiation in the absorption spectrum of $NaNO_2$ crystals are in the main caused by two effects: the conversion of NO_2^- ions into NO_3^- ions with an absorption band, which has its peak at 345 mμ and shows a characteristic structure when observed at low temperature: and the production of color centers with a continuous absorption band with peak at 335 mμ. The formation of the color centers is assumed to be connected with the presence in the lattice of NO_2^- ions, although no precise model can be proposed for these centers. The color center band can be bleached by ultraviolet light even at −190°C; at room temperature it is partially destroyed by the ionizing radiation which is able to produce the centers, while this is not the case with respect to the NO_2^- ions. Therefore the NO_2^- band is relatively much stronger in crystals exposed to the ionizing radiation at higher temperatures, for instance in the pile, while in crystals x-rayed at −190°C the color center band prevails. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2666 RDB(C)/TN-103

Culcheth Labs., Research and Development Branch, Industrial Group, United Kingdom Atomic Energy Authority (England)

THE PRODUCTION OF PURE NIOBIUM PENTOXIDE. (A REVIEW OF PROGRESS TO JUNE 30, 1954). R. Lind and M. P. O'Farrell. Feb. 11, 1955. 32p.

The potassium carbonate fusion of ferro-niobium has been studied as a first stage in the production of pure niobium pentoxide. Conditions for 100% efficiency have been established and the mixed earth oxides have been purified by solution methods to better than 99% purity. The separation of tantalum and niobium from oxalate solution has been studied. Partial separation of the tantalum from niobium has been achieved; the lowest tantalum content obtained was 0.45%. (auth)

2667

THE METHYLAMINE COMPLEXES OF THE RARE EARTH (III) CHLORIDES. Alexander I. Popov and Wesley W. Wendlandt (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 77, 857-9(1955) Feb. 20.

The addition of methylamine to lanthanum, cerium(III), praseodymium, neodymium, samarium and gadolinium chlorides was followed at 700 mm pressure from room temperature to 300°. Methylamine readily combines with the rare earth chlorides forming a series of complexes of the type $MCl_3 \cdot nCH_3NH_2$ where n varies from 5 to 1. Fractional compounds with n = 4.5, 3.25, ... down to 0.75 were observed in several cases. (auth)

2668

RADIATION-INDUCED Ce(III)-Ce(IV) EXCHANGE IN AQUEOUS NITRIC AND SULFURIC ACIDS. George E. Challenger and Burton J. Masters (Los Alamos Scientific Lab., New Mexico). J. Am. Chem. Soc. 77, 1063-4(1955) Feb. 20.

Solutions containing unlabeled Ce(IV) and labeled Ce(III) were irradiated with unfiltered 50-kvp x rays from a tungsten target. After irradiation, the Ce(IV) was extracted with butyl phosphate and the specific activity of this fraction determined. The radiation-induced exchange was calculated from this observed exchange rate by subtracting the spontaneous (thermal) exchange rate, which was determined by independent measurements. Exchange yields believed to be reliable to within 5 to 10% and the dosimetry yields to within 2% are presented. (auth)

2669

A MECHANISM FOR THE PHOTO-OXIDATION OF WATER BY CERIC ION. Thomas J. Sworski (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 77, 1074-5(1955) Feb. 20.

2670

LANTHANUM OXYCHLORIDE PHOSPHORS. Frank E. Swindells (E. I. du Pont de Nemours, Parlin, N. J.). J. Electrochem. Soc. 101, 415-18(1954) Aug.

Lanthanum oxychloride can be activated to show strong fluoresence under excitation by cathode rays. Bismuth as an activator gives a blue emission extending into the ultraviolet with the peak at 3580 A; antimony a greenish white with the peak at 4960 A, and samarium a reddish orange emission composed of a series of lines or narrow bands, the strongest of which are at 5640 A, 5770 A, 6060 A, and 6510 A. The phosphor activated with antimony has a blue emission when excited by 2537 A. (auth)

SEPARATION PROCEDURES

2671 MLM-967

Mound Lab.

THE RADIOCHEMICAL SEPARATION OF ACTINIUM AND ITS DAUGHTERS BY MEANS OF LEAD SULFATE. N. E. Rogers and R. M. Watrous. Apr. 23, 1954. 9p. Contract AT 33-1-GEN-53.

A method has been developed for separation of Ac^{227} and its radioactive daughters from rat urine by means of precipitated lead sulfate. Individual activities may be determined by counting and by application of calculations involving differential decay techniques. Approximately 90% of the activity in rat urine can be recovered. The method requires about eight hours. In the absence of large quantities of phosphorus the method should be applicable to the analysis of other biological materials. (auth)

2672

SEPARATION AND ANALYSIS OF GASES AND VOLATILE LIQUIDS BY GAS CHROMATOGRAPHY. H. W. Patton, J. S. Lewis, and W. I. Kaye (Tennesse Eastman Co., Kingsport, Tenn.). Anal. Chem. 27, 170-4(1955) Feb.

Gas chromatographic techniques were used to study the potentialities of selective adsorption and partition methods for the separation and analysis of gases and volatile liquids. Methods involving elution by hydrogen, nitrogen, or carbon

dioxide from columns containing charocal, silica gel, or alumina provided excellent separation of hydrocarbons and other nonpolar materials. Gas chromatographic elution is simple, accurate, and very effective for the identification and determination of the components of many gaseous and liquid mixtures, particularly of hydrocarbons. (auth)

2673

SEPARATION OF PLUTONIUM ISOTOPES FROM NATURAL URANIUM BOMBARDED BY PROTONS. Mario Alberto Rollier, Helge Tyren, Alessandro Malvicini, and Renato Repossi. Atti accad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 16, 493-9(1954) Apr. (In Italian)

A procedure is established for the chemical separation of Pu and U isotopes produced by the bombardment of U^{235} and U^{238} by 40-Mev protons. (K.S.)

2674

SEPARATION OF NATURAL RADIOELEMENTS BY MESITYL OXIDE. J. Marechal-Cornil and E. Picciotto. Bull. soc. chim. Belges 62, 372-82(1953). (In French)

Mesityl oxide is used for the quantitiative extraction of Th, Bi, and Po, present in concentrations below 10^{-9} g/cc in a nitrate-saturated solution of $Al(NO_3)_3$. Ra and Pb are not extracted. (tr-auth)

2675

THE BERYLLIUM-CITRATE SYSTEM. II. ION-EXCHANGE STUDIES. Isaac Feldman, T. Y. Toribara, Jean R. Havill, and W. F. Neuman (Univ. of Rochester School of Medicine and Dentistry, N. Y.). J. Am. Chem. Soc. 77, 878-81(1955) Feb. 20.

Ion-exchange studies have been performed on mixtures composed of radiotracer concentrations of beryllium isotope, Be^7, in excess citrate at various pH's, 34° and $\mu = 0.15$. The results in the pH range 3-4 are explainable on the basis of the existence of three complexes, BeH_2Cit^+, $BeHCit^0$ and $BeCit^-$, the respective instability constants being 4×10^{-2}, 6×10^{-3} and 3×10^{-5}. The results above pH 4 suggest that polynuclear complexes begin to form above this pH. In slightly alkaline solution there exists a complex having a charge more negative than −1. (auth)

2676

PREPARING SAMPLES FOR ABSOLUTE COUNTING. S. G. Rudstam (Univ. of Uppsala, Sweden). Nucleonics 13, 64-6 (1955) Feb.

The effects of sample scattering and absorption and backscattering from the sample support can be neglibible by utilizing only 0.1 mg of carrier. The chemical techniques for purifying radionuclides using very small amounts of carrier are described. The separation of Cu from an As target is used as an illustration. Samples are mounted by evaporating the solution on a thin Al foil. The standard deviation of 38 samples prepared by evaporation from a Co^{60} solution was found to be 1.7%. Cu, Zn, Ni, and Ga have been separated and purified by the described technique with satisfactory results. (M.P.G.)

SORPTION PHENOMENA

2677 AD-16020

Amherst Coll.

HEATS OF ADSORPTION OF ARGON ON A SERIES OF CARBON BLACKS GRAPHITIZED AT SUCCESSIVELY HIGHER TEMPERATURES. TECHNICAL REPORT NO. 3. R. A. Beebe, D. M. Young, and H. Bienes. June 30, 1953. 12p. Contract N8-onr-66902.

Calorimetric heats of adsorption were measured for A at −195°C on C black (Spheron 6) graphitized at 1000, 1500, 2000, and 2700°C. Experimental data are shown on isotherms and heat-coverage curves. The volumes adsorbed at a given pressure (up to $P/P_0 = 0.4$) decreased in the order of increasing graphitization but above $P/P_0 = 0.5$ the volume increased. Heat-coverage curves indicated that: (1) in the region $V/Vm = 0$ to 0.4 the differential heats decrease with the graphitization up to 2000°C but remain constant between 2000 and 2700°C, (2) in the region $V/Vm = 0.4$ to 1.0 the arrest changes to a maximum which becomes higher with graphitization, and (3) the slope of the curve near V_m increases with increased graphitization; beyond V_m a second maximum becomes more pronounced with the degree of graphitization. The major graphitization appeared to occur between 1000 and 2000°C. (auth)

SPECTROSCOPY

2678

TECHNIQUE FOR CONTINUOUS INTENSITY STANDARDIZATION IN QUANTITATIVE ANALYSIS BY NUCLEAR MAGNETIC ABSORPTION. R. H. Elsken and T. M. Shaw (U. S. Department of Agriculture, Albany, Calif.). Anal. Chem. 27, 290-2(1955) Feb.

A technique for nuclear magnetic absorption measurements provides for continuous comparison of the absorption signal with a reference standard. A Watkins-Pound calibrator circuit serves as a source of the reference signal. A sevo-system is used to compare continuously the magnitudes of the reference and absorption signals. The method facilitates accurate determination of absorption line intensity. (auth)

SYNTHESES

2679 CCC-1024-TR-87

New Hampshire Univ.

THE PREPARATION OF ALKALI METAL AMMONIUM AND TETRAALKYLAMMONIUM FLUOBORATES. C[harles] M. Wheeler, Jr. and R. Sandstedt. Jan. 17, 1955. 11p. [For Callery Chemical Co. Contract NOa(s) 52-1024-c].

The reactions of hydroxyfluoboric acid with potassium fluoride, sodium fluoride, sodium chloride, and ammonium chloride yielded the corresponding fluoborates. Tetramethyl-, tetraethyl-, tetra-n-propyl-, and tetra-n-butylammonium fluoborates were prepared by the reaction of the appropriate quaternary ammonium halide with fluoboric, monohydroxyfluoboric and/or methoxyfluoboric acids. The fluoborates show decreases in melting point with increased carbon chain length: tetramethyl-, 418°C; tetraethyl-, 365 to 367°C; tetra-n-propyl, 249 to 251°C; and tetra-n-butylammonium fluoborate, 153 to 155°C. Tetramethylene-bis-pyridinium fluoborate was prepared by the reaction of tetramethylene-bis-pyridinium bromide with fluoboric acid. Tetramethyl-, tetraethyl-, tetra-n-propyl, and tetra-n-butylammonium halides reacted with dimethyl ether-boron trifluoride to form alkyl quaternary fluoborates and alkyl halides. The reactions proceed smoothly at 50 to 60°C and are described by the following general equation: $4(CH_3)_2OBF_3 + 3R_4NX + 3R_4NBF_4 + 3CH_3X + B(OCH_3)_3 + (CH_3)_2O$ where R is the alkyl radical and X is chloride, bromide, or iodide. (auth)

2680 AEC-tr-2082

EXPERIMENTS WITH HETERODISPERSED "SEEDS." S. Maričić and I. Markovčić . Translated by Anne Sandel from Z. Anorg. u. allgem. Chem. 276, 193-203(1954). 11p.

The process of precipitation of aluminum hydroxide through seeding with industrially produced hydragillite is carried out quantitatively through the dispersion analysis of aluminum hydroxide in the beginning and end product. Also by this method of investigation, the observation holds true that by the formation of hydragillite through seeding of the aluminum hydroxide solution two processes occur: the formation of a new crystal and its future growth. The order of magnitude of each particle in the heterodispersed seeding substance is determined. This is active and plays an important role in the first 10 to 15 hours of the process. (auth)

2681

SYNTHESIS OF DIETHYL-4-NITROPHENYL-THIOPHOSPHATE AND ETHYL-4,4'-DINITRO-PHENYLTHIOPHOSPHATE, LABELED WITH RADIOACTIVE PHOSPHORUS P^{32} AND SULFUR S^{35}. Ya. A. Mandel'-baum, I. L. Vladimirova, and N. N. Mel'nikov (Samolov Research Inst. for Fertilizers and Insectofungicides). Doklady Akad. Nauk. S.S.S.R. 100, 77-9(1955) Jan. 1. (In Russian)

TRANSURANIC ELEMENTS AND COMPOUNDS

2682

SOME PHYSICAL PROPERTIES OF PLUTONIUM METAL. Eric R. Jette (Los Alamos Scientific Lab., N. Mex.). J. Chem. Phys. 23, 365-68(1955) Feb.

Data on some of the physical properties of plutonium metal are given, including allotropic modifications, crystal structures, transformation temperatures, melting point, densities, expansion coefficients, electrical resistance, and magnetic susceptibility. (auth)

2683

THE TRANSURANIC ELEMENTS. Georges Gueben. Rev. questions sci. (Belg.-France) 14, 161-80(1953) Apr. 20. (In French)

The chemical and physical properties of the elements and isotopes of atomic number 93 through 98 are discussed. (K.S.)

URANIUM AND URANIUM COMPOUNDS

2684

THE ELECTROPHORESIS OF SEVERAL URANIUM SALTS. Maurice Bachelet, Renee Claude, and Michel Lederer. Compt. rend. 240, 419-21(1955) Jan. 24. (In French)

2685

THE URANIUM–SYSTEM: $UO_{2.5}$ TO U_3O_8. H. R. Hoekstra, S. Siegel, L. H. Fuchs, and J. J. Katz (Argonne National Lab., Lemont, Ill.). J. Phys. Chem. 59, 136-8(1955) Feb.

Investigations under way on the uranium–oxygen system in the composition range $UO_{2.5}$ to U_3O_8 indicate that U_2O_5 does not exist; $UO_{2.56}$ represents the lower limit of the monophasic region below U_3O_8. Composition limits of the orthorhombic $UO_{2.6}$ phase appear to be $UO_{2.56}$ to $UO_{2.65}$. Transition to the U_3O_8 phase occurs above the composition $UO_{2.65}$. Single crystals of the $UO_{2.6}$ phase and U_3O_8 have been prepared. A metastable (β) modification of U_3O_8 has been observed on oxidation of the $UO_{2.6}$ phase. High temperature x-ray studies have not as yet shown the existence of βU_3O_8 as a high temperature form of U_3O_8, but do show the formation of a hexagonal structure above 400°. (auth)

2686

THE POTENTIOMETRIC REDUCTION OF URANYL CHLORIDE SOLUTIONS. H. K. El-Shamy and S. El-din Zayan (Alexandria Univ., Egypt). Analyst 80, 65-8(1955) Jan.

The optimum conditions for the potentiometric reduction of uranyl chloride solutions have been studied. The results showed that uranium could be accurately determined potentiometrically by direct reduction with chromous chloride solution to the quadrivalent state. The titration could be performed at room temperature, but equilibria were attained more rapidly and the inflections indicating complete reduction became steeper at higher temperatures. The presence of hydrochloric acid had a similar effect, and the fall of potential near the equivalence point was found to increase with the acidity and to reach a maximum in 8M hydrochloric acid. Titrations were performed at room temperature in presence of 8M hydrochloric acid and complexing acids. Equilibria were attained instantaneously and the inflections were sharper and steeper; tartaric acid had the maximum effect. The addition of potassium chloride was found to be more effective and improved the titration curves even when 0.1M hydrochloric acid was used at room temperature; increase of temperature or acidity improved the results considerably. (auth)

2687

AN IMPROVEMENT IN THE DETERMINATION OF URANIUM-235 BY RADIOACTIVATION. A. P. Seyfang (Springfields Works, Salwic, Lancs, England). Analyst 80, 74-6 (1955) Jan.

Results of the investigation indicate that the precision of a radioactivation method of analysis can be made equal to the precision of many of the more established chemical and physical methods used for other purposes. (J.E.D.)

WASTE DISPOSAL

2688

DESIGN OF CHIMNEYS TO CONTROL DOWN-WASH OF GASES. R. H. Sherlock and E. J. Lesher (Univ. of Michigan, Ann Arbor). Trans. Am. Soc. Mech. Engrs. 77, 1-9 (1955) Jan.

A method is described for wind-tunnel testing of models by which the design of a station building and its stacks can be determined so that the down-wash of the smoke plume toward the earth as a result of aerodynamic effects can be practically eliminated. (auth)

ENGINEERING

2689 KAPL-1265

Knolls Atomic Power Lab.

FROZEN SODIUM SHAFT SEAL. W[alter] A. Heywood. Aug. 4, 1954. 41p. Contract W-31-109-Eng-52.

The feasibility of utilizing a frozen sodium annulus as a shaft seal was investigated. The torque required to turn a shaft in a frozen annulus, the leakage of sodium past a frozen annulus, and the leakage of argon past a frozen annulus were studied. Torques up to 60 ft-lb were required to turn a $1\frac{5}{8}$ in.-diameter shaft in a frozen sodium

annulus 3 in. long and 1/16 in. thick. Sodium leak rates up to 4 g per day were observed with a 15-psi pressure drop across the annulus. Argon leak rates of the order of hundreds of cubic centimeters per minute with pressure drops up to 10 psi were observed. (auth)

2690 NP-5538
Continental Oil Co.
DEVELOPMENT AND EVALUATION OF A GREASE FOR −100° TO +350°F. QUARTERLY REPORT NO. 3 FOR PERIOD SEPTEMBER 15–DECEMBER 15, 1954. E. W. Nelson, W. W. Woods, R. M. Tillman, and B. P. Scott. Dec. 15, 1954. 19p. Contract AF33(616)-2364.

HEAT TRANSFER AND FLUID FLOW

2691 ANL-5319
Argonne National Lab.
ELECTRICAL, GEOMETRICAL ANALOGUE TECHNIQUES FOR THE SOLUTION OF TWO-DIRECTIONAL COMPLEX HEAT CONDUCTION PROBLEMS. Wallace R. Simmons. Sept. 1954. 55p. Contract W-31-109-eng-38.

Two electrical-geometrical analogs are presented for the determination of two-directional equipotential patterns of Poissonian fields created by uniformly or nonuniformly distributed sources for steady-state or transient conditions. The numerical values of these equipotential (isothermal) lines as applied to heat conduction problems are obtained directly from potential measurements through the use of a standard resistance. The accuracy of these techniques is demonstrated by comparing the results from the analogue with the analytical results for a number of steady-state and transient problems. (auth)

2692 BNL-2096
Brookhaven National Lab.
EFFECT OF VOID VOLUME AND PRANDTL MODULUS ON HEAT TRANSFER IN TUBE BANKS AND BEDS. Joel Weisman. [1954]. 30p.

A correlation is presented relating the heat transfer characteristics of cross-flow heat exchangers to the void volume and tube pitch ratio. A similar correlation is found to be applicable to heat and mass transfer in packed and fluidized beds, and through screens. A limited amount of data has been obtained on the effect of the Prandtl modulus at high Reynolds numbers. These data seem to indicate, as do those for flow through tubes, that the Prandtl number exponent is a function of Reynolds numbers. (auth)

2693 NACA-TN-3264
Lewis Flight Propulsion Lab., NACA
STUDY OF THE MOMENTUM DISTRIBUTION OF TURBULENT BOUNDARY LAYERS IN ADVERSE PRESSURE GRADIENTS. Virgil A. Sandborn and Raymond J. Slogar. [Aug. 10, 1954]. 79p.

Evaluation and analysis were made of the mean and turbulent terms of the equations of motion and the stress tensor at four stations in a turbulent boundary layer with a progressively increasing adverse pressure gradient. Evaluation of the terms of the turbulent stress tensor indicates that the normal stresses $\rho\overline{v^2}$ and $\rho\overline{w^2}$ and the shear stress $-\rho\overline{uv}$ are of comparable magnitude, while the normal stress $\rho\overline{u^2}$ was found to be roughly four times as large near the wall. The angle between the principal axis of the turbulent stress tensor and the boundary appeared to be largely independent of x-distance of pressure gradient. Evaluation of the x- and y-direction equations of motion shows that the rate of change normal to the wall of the mean square of the y-direction turbulent velocity in the y-direction equation when taken near the wall is as large as or larger than any term in the x-direction equation. The x- and y-momentum equations are, however, still independent. (auth)

2694 NACA-TN-3266
Lewis Flight Propulsion Lab , NACA
EXPERIMENTAL EVALUATION OF MOMENTUM TERMS IN TURBULENT PIPE FLOW. Virgil A. Sandborn. [Aug. 27, 1954]. 40p.

Terms of the longitudinal- and radial-direction turbulent momentum equations were experimentally evaluated in a 4 in. diameter pipe from total- and static-pressure data and hot-wire anemometer surveys. Terms of the r-direction momentum equation were found to be as large as terms of the x-direction equation. Direct comparisons were made with turbulence measurements obtained using the constant-current and constant-temperature systems of hot-wire anemometry. The two systems agree equally well within the experimental accuracy of the measurements. (NACA abst.)

2695 OSR-TN-54-203
Pennsylvania State Univ.
BOUNDARY LAYER CONTROL BY POROUS SUCTION. TECHNICAL REPORT NO. 3. H. G. Lew and R. D. Mathieu. June 1954. 124p. Contract AF18(600)-575. (AD-41436)

A survey of some of the theoretical work in the boundary layer control problem by porous suction is given. Recommendations for future work are given after careful evaluation of the problem. 65 references. (auth)

2696
EXPERIMENT ON APPLICATION OF RADIOACTIVE ISOTOPES TO INVESTIGATION OF THE PURITY OF STEAM IN SEMIINDUSTRIAL HIGH-PRESSURE BOILERS. I. Kh. Margulova. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 8, 29-36(1954) Aug. (In Russian)

Determination of excess phosphate, moisture content, and general salt content in the steam of high-pressure (110 and 185 atm) boilers by the use of radioactive P, S, and Na isotopes is described. (G.Y.)

2697
HEAT TRANSFER PERFORMANCE CURVES. Irving Granet (Foster Wheeler Corp., New York). Chem. Eng. 62, No. 3, 187-90(1955) Mar.

The curves presented can be used to find the heating surface directly since it will be the only unknown. The effect of fouling of the convection surfaces on the performance of the unit can also be predicted. Conversely, after an exchanger has operated for a while, the amount of fouling can be predicted from the change in thermal efficiency. (L.M.T.)

2698
ON THE QUESTION OF APPROXIMATE INTEGRATION OF EQUATIONS OF PLANE STEADY SUPERSONIC MOTION OF GAS. A. A. Grib and A. G. Ryabinin (Leningrad State Univ.). Doklady Akad. Nauk S.S.S.R. 100, 425-8(1955) Jan. 31. (In Russian) (G.Y.)

2699
PULSATING-FLOW MEASUREMENT. A LITERATURE SURVEY. A. K. Oppenheim (Univ. of California, Berkeley) and E. G. Chilton (Shell Development Co., Emeryville, Calif.). Trans. Am. Soc. Mech. Engrs. 77, 231-48(1955) Feb.

Technical publications on the measurement of pulsating flow are reviewed. Fundamental aspects of the subject are stressed, and applications of pressure-differential meters are emphasized because of their importance to industry. Problems related to these meters are classified into those concerned with flow through the meter test section, the effect of the flow system on the meter, and the transmission of the signal from meter to recorder. Operation and application to pulsating flow of other meters such as the turbine type and electromagnetic flowmeter, the hot-wire anemometer, and the so-called "true mass-rate flowmeter" also are outlined. A summary of information available in codes and manuals is included. (auth)

WASTE DISPOSAL

2700 APEX-179
General Electric Co. ANP Project
CLOUD DOSAGE CALCULATIONS. R. L. Waterfield. Apr. 5, 1954. 11p. Contracts AT(11-1)-171 and AF 33(038)-21102. (XDC-54-4-12)

The dosage from a radioactive cloud formed by a sudden release of fission products from a stack is calculated by means of Sutton's diffusion equation (Proc. Roy. Soc. (London) 135, p. 143). (L.M.T.)

2701
VAPOR COMPRESSION EVAPORATION HANDLES RADIOACTIVE WASTE DISPOSAL. Bernard Manowitz, Powell Richards, and Robert Horrigan (Brookhaven National Lab., Upton, N. Y.). Chem. Eng. 62, No. 3, 194-6(1955) Mar.

The 300-gph concentration and disposal unit used at Brookhaven National Lab. is briefly described, with operation methods and some cost factors included. (L.M.T.)

MINERALOGY, METALLURGY, AND CERAMICS

2702 NYO-6297
Massachusetts Inst. of Tech.
STUDY OF METAL-CERAMIC INTERACTIONS AT ELEVATED TEMPERATURES. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JANUARY 1, 1955. W. D. Kingery and F. H. Norton. 11p. Contract AT(30-1)-1192.

Measurements of surface tension and wetting for additions of S, O, N, and C to iron have been completed. Measurements of Fe—Se compositions indicate that Se is markedly surface active. Measurements with Fe—Te and Ni—Sn indicate that Te and Sn are only moderately surface active. Compositions of Ni—Cr have been prepared, and measurements of the temperature coefficient of the surface tension of nickel are in progress. A number of alloys containing small amounts of Ti and Zr have been prepared for investigation of wetting and its effect on composite properties. Sintering studies of CaF_2 and NaF indicate that a diffusion process is operative in both of these materials. (auth)

CERAMICS AND REFRACTORIES

2703 AD-23431
American Electro Metal Corp.
INVESTIGATION OF THE EFFECT OF RAW MATERIAL PRODUCTION VARIABLES ON THE PHYSICAL AND CHEMICAL PROPERTIES OF CARBIDES, NITRIDES, AND BORIDES. PROGRESS REPORT NO. 9 FOR THE PERIOD SEPTEMBER 1 TO OCTOBER 31, 1953. H. Blumenthal. 17p. Contract AF33(616)-89.

A flotation procedure was developed by which free C present in TiC can be reduced to less than 0.05%. The procedure also makes possible the separation of particle size fractions in a range below 5 μ. Hot pressing of transverse rupture bars of Ni-bonded TiC to maximum density resulted in loss of binder and was, therefore, discontinued. Hot pressing at temperatures where no binder was lost, followed by sintering in vacuum, resulted in dense pieces without the loss of binder. Various procedures of ball milling with a liquid medium in different ball mills are being investigated. The ball-milled powders are cold pressed wet and vacuum sintered. Dense bars resulted only when ball milling and ball mill mixing were done simultaneously in a W carbide mill for 144 hr. Infiltration experiments showed that a surface film of TiO_2 is essential for the complete infiltration of a porous TiC bar. If not properly controlled, however, the process may proceed in a way that produces a well infiltrated outer case which prevents complete infiltration and leaves the core of the piece free from the infiltrant. (ASTIA abst.)

2704
DIELECTRIC PROPERTIES OF LEAD-STRONTIUM TITANATE. Shoichiro Nomura and Shozo Sawada (Univ. of Tokyo, Japan). J. Phys. Soc. Japan 10, 108-11(1955) Feb.

The dielectric and thermal properties and lattice dimensions of lead·strontium titanate were investigated, the solid solution being realized in the whole range of molar percentage. It was found that lead·strontium titanate is also ferroelectric as lead·barium titanate and barium·strontium titanate. As the content of Sr^{2+} increases, the lattice volume and tetragonality decrease. The Curie temperature decreases linearly with the increase of the content of Sr^{2+} and any other transition point was not observed. Curie-Weiss formula holds above Curie temperature, the value of Curie constant being $(3 \sim 9) \times 10^{4}$°C. (auth)

2705
DIELECTRIC PROPERTIES OF TITANATES CONTAINING Sn^{4+} IONS. I. Shoichiro Nomura (Univ. of Tokyo, Japan). J. Phys. Soc. Japan 10, 112-19(1955) Feb.

Dielectric and thermal properties and lattice constants of the solid solutions of $Pb(Ti{\cdot}Sn)O_3$ and $Ba(Ti{\cdot}Sn)O_3$ were investigated, for the purpose of making clear the role of Y ion in the compounds of the perovskite type, XYO_3. In $Pb(Ti{\cdot}Sn)O_3$, according to the X-ray analysis, two phases seem to co-exist in the samples containing Sn^{4+} ions more than 75%, although the whole range solid solution might be expected from the standpoint of the "tolerance factor". The Curie point moves to the low temperature side with the increase of the content of $PbSnO_3$ and reaches 200°C in $Pb(20\%Ti{\cdot}80\%Sn)O_3$. In $Ba(Ti{\cdot}Sn)O_3$, a rather steep decrease of the Curie temperature with the content of Sn^{4+} ions occurs and the whole range solid solution seems to be realized, although the X-ray analysis was not thoroughly made in this case. The dielectric constant D ~ E hysteresis loop, thermal expansion and specific heat were observed. An anomalous hysteresis phenomenon was observed in $Pb(25\%Ti{\cdot}75\%Sn)O_3$ which suggests that Ti^{4+} Ion and Sn^{4+} Ion respond differently to the external field in the ferroelectric state. Several speculations were mentioned with respect to this phenomenon. (auth)

CORROSION

2706 NACA-TN-3281
Columbia Univ.
INTERGRANULAR CORROSION OF HIGH-PURITY ALUMINUM IN HYDROCHLORIC ACID. I. EFFECTS OF HEAT TREATMENT, IRON CONTENT, AND ACID COMPOSITION. M. Metzger and J. Intrater. [June 25, 1953]. 38p.

The intergranular corrosion of high-purity aluminum in hydrochloric acid was studied as a function of iron content, heat treatment, and acid composition under conditions where the rate of intergranular penetration was of the order of 1 millimeter per week. The behavior of specimens quenched to retain a single-phase structure indicated the rate of attack on the high-angle grain boundaries to be influenced by the segregation in these boundaries of iron and possibly other impurity atoms. (NACA abst.)

GEOLOGY AND MINERALOGY

2707 NP-5545
Centre de Physique Nucléaire de l'Université Libre de Bruxelles
RADIOACTIVITE SUPERFICIELLE DES ROCHES—FORMULES. (The Surface Radioactivity of Rocks—Formulas). ([NOTE]NO. 28.) M. Van Stijvendael. July 1951. 5p.

Equations are developed which provide for the accurate detection of surface radioactivity by the use of photographic plates. The method provides for the elimination of unwanted tracks by ignoring those below a certain track length, and yields data that are independent of emulsion contraction after development. (K.S.)

2708 RME-2011
Division of Raw Materials, AEC
PRELIMINARY REPORT ON THE URANIUM OCCURRENCE OF THE JEEP NO. 2 CLAIM, CLARK MOUNTAIN MINING DISTRICT, SAN BERNARDINO COUNTY, CALIFORNIA. Robert L. Hillier. June 1954. 11p.

Anomalous radioactivity and a visible uranium mineral occur in small replacement bodies in limestone at the Jeep No. 2 claim, Clark Mountain mining district, San Bernardino Co., Calif. Carnotite coating brown jasper is associated with oxidized copper, zinc, lead, and manganese minerals. Situated a few miles west of the thorium and rare earth deposits of the Mountain Pass area, the claim is in typical barren, rugged desert terrain. The deposits appear to be small, spotty, and low-grade though a certain amount of exploration may be warranted to determine the possibilities of finding more substantial mineralized zones in the area. (auth)

2709 TEM-443A
Geological Survey
TRACE ELEMENTS RECONNAISSANCE INVESTIGATIONS IN NEW MEXICO AND ADJOINING STATES IN 1951. George O. Bachman and Charles B. Read. Oct. 1952. 22p.

A reconnaissance search was made in N. Mex. and adjacent states for uranium in coal and carbonaceous shale, chiefly of Mesozoic age, and black marine shale of Paleozoic age. Tertiary volcanic rocks, considered to be a possible source for uranium in the coal and associated rocks, were examined where the volcanic rocks were near coal-bearing strata. Uranium, possibly in commercial amounts, was found at La Ventana Mesa, Sandoval Co. N. Mex. Slightly uraniferous coal and carbonaceous shale were found near San Ysidro, Sandoval Co., and on Beautiful Mountain, San Jaun Co., all in N. Mex., and at Keams Canyon, Navajo Co., and near Tuba City, Coconino Co., in Ariz. Except for the La Ventana deposit, none appeared to be of economic importance at this time, but additional reconnaissance investigations have been underway this field season, in the areas where the deposits occur. Marine black shale of Devonian age was examined in Oteto and Socorro Counties, N. Mex. and Gila Co., Ariz. Mississippian black shale in Socorro Co. and Pennsylvania black shale in Taos Co., N. Mex. also were tested. Equivalent uranium content of samples of these shales did not exceed 0.004%. Rhyolitic tuff from the Mount Taylor region is slightly radioactive as is the Bandelier tuff in the Nacimiento region and in the Jemez Plateau. Volcanic rocks in plugs and dikes in the northern Chuska Mountains and to the north in N. Mex. as well as in northeastern Ariz. and southeastern Utah are slightly radioactive. (auth)

2710
RADIOACTIVE PHENOMENA IN GEOLOGY. E. E. Picciotto. Bull. soc. belge geol. paleontol et hydrol. 59, Nos. 1 and 2, 103-35(1950). (In French)

The basic laws of radioactivity are briefly reviewed. After a discussion of the concept of natural radioactivity and the importance of these elements in geology, the principal applications of radioactivity to the geological sciences are reviewed. These include the thermal evolution of the earth, absolute age measurements, the role of radioactive processes in mineralogy, petrography, and geochemistry, and their uses in applied geology. (tr-auth)

2711
AN ATTEMPT AT CLASSIFICATION OF URANIUM AND THORIUM DEPOSITS. Marcel Roubault. Compt. rend. 240, 214-16(1955) Jan. 10. (In French)

A proposal is made to classify U deposits as (1) included or segregated igneous deposits and their evolutionary products (uraninite, davidite, brannerite, and oxide complexes), (2) "hydrothermal" vein deposits of pitchblende and localized secondary products, and (3) sedimentary deposits of Th and U. (K.S.)

2712
ON THE AUTHENTICITY OF THE DETERMINATION OF THE ABSOLUTE AGE OF URANIUM MINERALS BY LEAD ISOTOPE RATIOS. A. I. Tugarinov (Vernadskii Inst. of Geochemistry and Analytical Chemistry). Dokady Akad. Nauk S.S.S.R. 99, 1061-3(1954) Dec. 21. (In Russian)

An example of widely differing ages of a U mineral obtained by Pb^{207}/Pb^{206}, Pb^{207}/U^{235}, and Pb^{206}/U^{238} ratios is presented. (G.Y.)

2713
TRACE-QUANTITY ANALYSIS: NEUTRON ACTIVATION APPLIED TO POTASSIUM-MINERAL DATING. A. Moljk, R. W. P. Drever, and S. C. Curran (Glasgow Univ., Scotland). Nucleonics 13, No. 2, 44-6(1955) Feb.

Measuring the A^{40} content of K minerals determines their age. Exposing only separated A in a reactor eliminates the possibility of forming complicating radioisotopes. Monitoring a sample of pure A is used to check on purity of separated A. The method can measure 30 to 40×10^{-9} g of A^{40}. (auth)

2714

HOW DRILL-HOLE DIAMETER AFFECTS GAMMA-RAY INTENSITY. Seymour C. Hyman, Bertram Minushkin, and Jeremiah Certaine (Nuclear Development Associates, Inc., White Plains, N. Y.). Nucleonics 13, No. 2 49-50(1955) Feb.

The γ-ray intensity in a cylindrical hole in a radioactive ore body is shown to be independent of hole size. The experiments and confirming theory are presented. (L.T.W.)

2715

NUCLEAR GEOLOGY. A SYMPOSIUM ON NUCLEAR PHENOMENA IN THE EARTH SCIENCES. Henry Faul, ed. New York, John Wiley and Sons, Inc., 1954. 414p.

An introduction to nuclear physics and a description of instruments and techniques for radiation detection and measurement are presented. The occurrence of radioactive elements in rocks and oceans is discussed, and thermal, physical, and chemical effects of radioactivity are considered. Nuclear methods of geophysical exploration and well logging and the techniques and results of absolute age determination are outlined. The ultimate in geologic problems, the origin of the earth, is discussed. (J.E.D.)

METALS AND METALLURGY

2716 AD-16317

Powder Metallurgy Lab., Renaselaer Polytechnic Inst.

ALUMINUM POWDER METALLURGY. QUARTERLY PROGRESS REPORT NO. 2. A. B. Backensto, Jr. and F. V. Lenel. June 8, 1953. 19p. Contract AF33(616)-351.

Equipment and techniques were developed for: (1) the removal of fatty acid lubricant from flake powder, (2) the hot pressing and extrusion of powder compacts, (3) the determination of oxide content of powdered and solid samples, and (4) the determination of the covering capacity of flake–Al powder. The highest percentage (4.21) of fatty acid lubricant was removed by heating the flake–Al powder for 30 min at 375°C and 1-mm pressure. Hot-pressed billets were made from MD 7100 flake–Al powder under the following conditions: a cold-compacting pressure of 25 tsi and a hot-pressing temperature, pressure, and time of 1000°F, 30 tsi, and 15 min, respectively. Cold-compact and hot-pressed billet densities of 2.1 to 2.2 and 2.6 g/cc, respectively, were obtained. One-inch extrusion samples were made at extrusion temperature, force, and speed of 1000°F, 10-12 tons, and 6-28 in./min, respectively, and a reduced area of 4:1. The oxide contents (determined by the HCl method) of Al powders (different grades as received) were from 1.4 to 11.4% by weight. The finest powder increased from 11.4 to 15.7% during vacuum treatment at 375°C. Preliminary determinations were made of the surface area of flake powders on water. The covering-capacity measurements on MD 7100 flake–Al powder gave 21,000 sq cm/g with about 4% reproducibility. The oxide content calculated from the oxide thickness was 14%. Rockwell E hardness results are given for sintered-Al-powder extrusions from various sources. The values were from 34 to 100. Diagrams of equipment and specimens are given as well as procedures and tabulated data. (auth)

2717 AD-19228

Mallory, P. R., and Co., Inc.

THE MANUFACTURE OF TITANIUM ALLOYS. REPORT NO. 7 (FINAL), FEBRUARY 6, 1952 TO APRIL 30, 1953. (MEMO NO. 8000-M-506). L[ee] S. Busch, R. H. Dickinson, G. William Bauer, R. J. Morris, and H. C. Pulsifer. May 14, 1953. 87p. Contract NOa(s)-52-614-c.

Microstructure data indicated that a nucleation and growth, and a martensitic transformation mechanism, are operative in the transformation of β in the 3% Al–5% Cr–balance Ti alloy. Transformations above 725°C take place by nucleation and growth; below this value they occur very rapidly by a nucleation mechanism. Water quenching produces a clear martensitic structure. The best tensile properties obtained on $\frac{5}{8}$-in.-diam. bars of this alloy by isothermal transformation occurred on low-carbon material transformed at 670 to 760°C for 120 min. Additional data indicated that a nucleation and growth mechanism takes place in the transformation of β between 950 and 600°C in the 2% Al–2% Fe–balance Ti alloy. Below 600°C the transformation is martensitic. Boron additions of 0.5% did not strengthen Ti alloys quite as much as similar Si additions. The most satisfactory annealing temperature for unalloyed Ti sheet was 700°C for an optimum period of 1 hr. Charpy impact specimens machined from $\frac{5}{8}$ in.-diam. arc-melted Ti-forged rod responded to a 1-hr, 371°C NaOH bath treatment with a 35.3-ft-lb impact value as compared to an average of 19.5 ft-lb for as-forged and machined specimens. (ASTIA abst.)

2718 AD-22087

Stanford Univ. School of Mineral Sciences

INVESTIGATION OF THE EFFECT OF ATMOSPHERE REACTION ON THE DETERIORATION OF METALS AT ELEVATED TEMPERATURES. FINAL REPORT. O. Cutler Shepard. July 30, 1953. 48p. Contract N6ori-154, Task V.

An investigation was made to ascertain whether the intergranular rupturing of metals at high temperatures and low strain rates is due to environmental damages or whether it results from inherent metallic behavior. An apparatus was devised for studying the stress-rupture behavior of metals in an inert gas or in a high vacuum. A commercial high-nickel alloy tested at 1600°F exhibited a greater life in air than in a high vacuum or in N, He, or H. In the absence of oxidation, the metals appear to be vulnerable to penetration and damage by constituents of the environment. Tests with high-purity Au showed that in the absence of environmental damage metals at high temperatures and low strain rates tend to fail by intergranular rupturing. Criteria are proposed for distinguishing intergranular failures caused by environmental damage from intergranular failures due to inherent metallic behavior. Internal friction measurements of Au were made by the torsion pendulum apparatus to obtain a measure of the activation energy of grain boundary stress relaxation. The various explanations offered for the mechanism of intergranular failure because of inherent metallic behavior are discussed. A theory that the high-temperature intergranular rupturing of metals is due to the collection of lattice vacancies at grain boundaries and the coalescence of vacancies into ruptures agrees with observations of the rupturing of Au. A new theory is offered to explain the weakening of metals at high temperatures in the presence of H. (ASTIA abst.)

2719 AD-26512

Armour Research Foundation

TITANIUM ALLOYS FOR ELEVATED TEMPERATURE APPLICATION. QUARTERLY REPORT NO. 9 [FOR]

JUNE 1, 1953 TO AUGUST 31, 1953. W[illiam] F. Carew, F[rank] A. Crossley, and H[arold] D. Kessler. Nov. 18, 1953. 48p. Contract AF33(038)-22806.

Tensile and stress-rupture tests were conducted on the iodide Ti–6% Al–0.2% and 0.5% O alloys at 425 and 550°C. The addition of 0.2% O to the iodide Ti-base alloy did not cause embrittlement as shown by the moderate ultimate strength and high ductility (137,400 psi with 16.8% elongation); the 0.5% O addition, however, caused extreme embrittlement. With increasing temperature, the 0.5% O alloy gained ductility and strength which surpassed that of the 0.2% O alloy. Tensile data are reported for Ti alloys with 8% Al, 6% Al–0.5% Si, 8% Al–4% Cr, 6% Al–2% and 4% V, 8% Al–2% and 4% V, and 8% Al–1% Si. Various heat treatments failed to improve the ductility of Ti–8% Al–4% Mo alloy; tensile elongations did not exceed 2% in 1 inch. Creep-rupture data were compiled on binary 4% and 8% Al alloys, a 30% Mo β alloy, and a 6% Al–0.5% Si ternary alloy. Three binary Ti–6% Al creep specimens showed no embrittlement at room temperature after 100 to 200 hr of exposure under stress elevated temperatures. Microstructural evidence from a creep specimen of 30% Mo indicated its structural instability under conditions of long exposure at 425°C while under stress. Microstructures are shown and correlated with the mechanical properties of the alloys Ti–Al–Si, Ti–15% Cr, and Ti–8% Al–4% Mo. (ASTIA abst.)

2720 AD-27864

Research [Lab.], Allegheny Ludlum Steel Corp.

WROUGHT AND CAST HIGH TEMPERATURE ALLOYS. PROGRESS REPORT NO. 2 [FOR] JUNE 16, 1953 TO SEPTEMBER 15, 1953. R. R. MacFarlane, R. S. DeFries, E. E. Reynolds, and W. W. Dyrkacz. Sept. 1953. 23p. Contract AF18(600)-149.

Rupture test results at 1500 to 1700°F are reported for nine S-816 alloys modified with variations in Ni, Cr, W, Mo, C, and Cb + Ta. One heat with 1% Cb + Ta and 0.12% C showed superior rupture results. Good rupture results were also obtained for a heat with 25% Cr and 10% W. Cb in U-912 type alloys was replaced by Cb + Ta with no apparent effect on rupture properties at 1500°F. A series of 10 heats of Fe–Mn–Cr austenitic steels were tested to determine the effect of variations in C, N, V, and Cr. Lower N improved notch-rupture life but impaired room-temperature tensile and 1200°F rupture properties. Two heats with low V (0.30 and 0.35%) had very low rupture strength at 1200°F, as compared with a heat with 0.78% V. Three heats of cast Vitallium, F-88, and F-87 alloys were made to evaluate the thermal shock properties and correlate rupture and room-temperature properties with thermal shock resistance. Thermal shock failure occurred in Vitallium after 1200 to 3000 cycles in the 800 to 1900°F range. Microexamination revealed that the shock cracks were intergranular and did not appear to begin at the microscopic defects in the as-cast structure. (See also AD-26137) (auth)

2721 AD-28937

Armour Research Foundation

A STUDY OF A FAMILY OF LAVES-TYPE INTERMEDIATE PHASES. QUARTERLY REPORT NO. 3 [FOR] SEPTEMBER 1, 1953–NOVEMBER 30, 1953. R[odney] P. Elliott, W[illiam] Rostoker, and D[onald] J. McPherson. Dec. 23, 1953. 16p. Contract AF18(600)-642.

X-ray pattern data were obtained in the temperature range 800 to 1200°C for 62 binary systems made from combinations of the following: Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zr, Nb, Mo, Hf, Ta, and W. Melting temperatures of the alloys were determined, and samples were prepared for heat treatment at temperatures between 1200°C and the melting temperature. (ASTIA Abstract)

2722 AD-33442

Battelle Memorial Inst.

INVESTIGATIONS OF RHENIUM. QUARTERLY PROGRESS REPORT NO. 7 FOR THE PERIOD DECEMBER 23, 1953 TO MARCH 22, 1954. C. T. Sims, D. N. Gideon, D. M. Rosenbaum, C. M. Craighead, E. N. Wyler, E. M. Sherwood, R[obert] I. Jaffee, F. C. Todd, and I[vor] E. Campbell. Mar. 22, 1954. 67p. Contract AF33(616)-232.

Fabrication of fine wire and thin sheet by swaging, round wire drawing, Turk's-head wire drawing, and rolling is discussed. A new melting point is reported and data are also included on thermal expansion and cold-worked density. The elevated tensile properties of annealed and cold-worked rhenium and a study of the high-temperature porosity problem are described. Initial pulse emission data for rhenium–barium aluminate-impregnated cathodes, previous results of thermionic-emission constants of pure rhenium, and data on material loss by the water-cycle mechanism are discussed. The method for a determination of the secondary-electron-emission coefficient and preliminary data are included. An appendix is attached, giving calculations of the boiling point and vapor pressure of liquid rhenium. (auth)

2723 AECU-2993

Los Alamos Scientific Lab.

HEALTH HAZARDS IN MIST COOLING. H. F. Schulte. [1954?]. 5p. Contract [W-7405-eng-36].

The use of mist cooling instead of a solid stream in machine tool practice is discussed. Possible health hazards due to the inclusion of dissolved toxic substances in the cooling mists are discussed and control measures are proposed to assure safety when mist cooling is used. (C.H.)

2724 BM-RI-5107

Bureau of Mines

CHROMIUM-BASE ALLOYS. R. G. Nelson and H. G. Anderson. Jan. 1955. 20p.

Chromium-base alloys containing 60% chromium and 40% iron with oxygen contents of the order of 0.01 to 0.03% showed excellent ductility with elongation values as high as 15% in the hot-worked state and 17% in the heat-treated condition. Similar alloys with oxygen analyses of about 0.2% showed up to 14% elongation after heat treatment but had little or no ductility in the hot-worked state. There was evidence of ductility in alloys containing as much as 70% chromium. Adding deoxidizers of aluminum and titanium to the 60Cr–40Fe alloy lowered the indicated oxygen analysis as obtained by vacuum fusion. These additions lowered the ductility by causing intergranular failure. The creep-rupture properties of alloys of 60 and 70% chromium, balance iron, showed that they are not suitable for high-stress, high-temperature applications. (auth)

2725 DP-94

Aeroprojects, Inc.

ULTRASONIC SOLDERING OF ALUMINUM. J. Byron Jones and John G. Thomas. Dec. 1954. 81p. For E. I.

du Pont de Nemours and Co. Explosives Dept. Atomic Energy Div. Contract AT(07-2)-1.

Aluminum joints including one zinc–aluminum–silicon and nine tin–zinc–aluminum solder compositions were appraised for resistance to corrosion in an environment of 95°C, aerated, distilled water. The effect of pure zinc and pure aluminum metal over-sprays on extending the life of soldered aluminum joints was examined, with the aluminum spray proving to be effective. A soldered joint life up to about 1000 hours in the stipulated environment is indicated. Avenues for potential improvement in corrosion resistance of soldered aluminum joints are suggested. (auth)

2726 ISC-564

Ames Lab.

THE URANIUM–CHROMIUM SYSTEM. A[drian] H. Daane and A. S. Wilson. [Jan. 26, 1955]. 8p. Contract [W-7405-eng-82].

The uranium–chromium system is of the simple eutectic type with some solid solubility of chromium in gamma and beta uranium. The eutectic occurs at 20 at.% chromium and melts at 859°C. The maximum solubility of chromium in gamma uranium is 4 at.% at the eutectic temperature, and in beta uranium, the solubility is estimated to be 1 at. %. The gamma-beta and beta-alpha transformations were found to occur at 737 and 612°C, respectively. (auth)

2727 NP-5528

Massachusetts Inst. of Tech.

PERIODIC STATUS REPORT NO. 10 [FOR PERIOD] NOVEMBER 1954–JANUARY 1955. I. DEFORMATION STUDIES OF METALS AT ELEVATED TEMPERATURES. II. THE IRON–CHROMIUM–NICKEL TERNARY SYSTEM. III. EFFECT OF STRUCTURE AND COMPOSITION OF THE STRENGTH PROPERTIES OF STAINLESS STEEL. IV. EFFECT OF COLD WORK ON THE STRENGTH PROPERTIES OF STAINLESS STEELS. N[icholas] J. Grant, H. C. Chang, P[eter] E. Price, F. C. Monkman, and F. B. Cuff. 7p. Contract N5-ori-07881.

Intercrystalline failure of 20% Zr–Al alloy, creep tested at stresses of 2000 to 5000 psi at 500°F, is very briefly discussed. Vacuum melting and casting of Fe–Cr–Ni ternary alloys and correction of apparatus failure by annealing the closed-end quartz tubes are discussed. Chemical analysis, x-ray fluorescence, and spectrographic analysis of vacuum- and induction-melted stainless steel to determine the effect of structure and composition on the stress-rupture properties at 1300°F were made and results reported. The effect of cold work and ferrite produced on the strength properties of 18-8 type stainless steels is discussed. (J.A.G.)

2728 NP-5530

Armour Research Foundation

INCREASING THE RATIO OF MODULUS OF ELASTICITY TO THE DENSITY OF TITANIUM ALLOYS. QUARTERLY REPORT NO. 2 [FOR] JUNE 15, 1954–SEPTEMBER 15, 1954. W. H. Graft and W. Rostoker. Oct. 18, 1954. 16p. Contract AF 33(616)-2355.

The effects of Al, V, Cu, and C binary alloying on the room-temperature dynamic elastic modulus of Ti were determined and its ratio of increase to the density (E/ρ) compared. Vanadium additions up to 31.3% by weight resulted in inferior values of elastic modulus and E/ρ when compared to unalloyed Ti. Copper additions from 0 to 11.5% by weight produced a moderate increase in the elastic modulus and the E/ρ ratio remained unchanged. A marked increase in both the elastic moduli and E/ρ ratios resulted with additions of 0 to 0.85% by weight C and with 0 to 7.9% by weight Al. A 7.9% Al addition resulted in an increase of 15.4% in the elastic modulus and 21.2% in the E/ρ ratio. A 0.85% C addition resulted in an increase of 16.6% modulus of elasticity and 18.1% ratio. (For preceding period see NP-5529.) (J.A.G.)

2729 NP-5531

Battelle Memorial Inst.

THE EFFECT OF MICROSTRUCTURE ON THE MECHANICAL PROPERTIES OF TITANIUM ALLOYS. INTERIM REPORT NO. 4. HEAT TREATMENT AND MECHANICAL PROPERTIES OF TITANIUM–MOLYBDENUM ALLOYS. F. C. Holden, H. R. Ogden, and R[obert] I. Jaffee. Dec. 1, 1954. 46p. Contract DA-33-019-ORD-1397.

Mechanical properties of the Ti–Mo alloys, like those of the Ti–Mn alloys, are dominated by the quantity and composition of beta phase present in the microstructure. Extensive alpha-beta annealing treatments are required to reach equilibrium at the lower annealing temperatures. Soft, ductile beta phase can be formed readily by quenching the alloy specimen, although high hardness values are obtained by aging the specimen at 400 C. Formation of strain-induced martensite in retained beta in the composition range of 8 to 16 per cent molybdenum results in low yield-to-ultimate strength ratios, high uniform elongation, and high resistance to impact. (For preceding period see NP-5473.) (auth)

2730 NP-5535

Metallurgical Advisory Committee on Titanium

STATUS BULLETIN NO. P15 ON UNCLASSIFIED TITANIUM RESEARCH AND DEVELOPMENT OF ARMY ORDNANCE CORPS. Nov. 1954. 62p.

Progress is reported on the following: titanium reduction and chemical thermodynamics, melting, casting, hot and cold shaping, powder metallurgy and ceramics, welding and brazing, machining and grinding, surface protection, alloying and heat treatment, plastic deformation, and extractive metallurgy.

2731 NP-5539

Institute for the Study of Rate Processes, Univ. of Utah

EFFECT OF TEMPERATURE AND ADDITIVES ON THE CREEP PROPERTIES AND RECRYSTALLIZATION OF ALUMINUM OXIDE. TECHNICAL REPORT NO. XLII. Harold P. Cahoon and Carl J. Christensen. Jan. 15, 1955. 115p. Contract N7-onr-45101.

The creep rates of recrystallized alumina, alumina with 0.285% magnesium addition, and of cuprite as a function of temperature at constant load have been measured. The creep parameters were calculated using the Gibbs and Eyring rate equations for ceramic materials. These parameters were found to be reasonable in value. It was found that negative creep could be eliminated by proper annealing. Shrinkage, porosity, and crystal development as observed in thin sections have been employed in a study of the sintering and recrystallization of alumina. Various sources of alumina, method of preparation, controlled amount of impurities, and temperature were the variables investigated. It has been observed that impurities may either increase of decrease both crystal size and rate of recrystallization. (auth)

2732 NP-5540
Minerals Research Lab., Inst. of Engineering Research, Univ. of Calif., Berkeley
EFFECT OF STRUCTURE ON CREEP AT HIGH TEMPERATURES. O[leg] D. Sherby, T. A. Trozera, and J[ohn] E. Dorn. Feb. 1, 1955. 30p. Contract N7-onr-295, T. O. II, Technical Report No. 39.

Structural changes attending creep at high temperatures and high stresses are dependent on the preceding creep stress history. Results on aluminum solid solution alloys indicate that initial plastic straining upon application of a constant stress decreases the creep resistance whereas the straining during creep increases the creep resistance. At low stresses the structural changes important to creep are minor. Neglecting transients that were observed upon change of stress, high temperature creep at low stresses obeys a mechanical equation of state. (auth)

2733 NP-5541
Minerals Research Lab., Inst. of Engineering Research, Univ. of Calif., Berkeley
ACTIVATION ENERGY FOR HIGH TEMPERATURE CREEP OF HIGH PURITY ALUMINUM. H. I-Lieh Huang, O[leg] D. Sherby, and J[ohn] E. Dorn. Feb. 15, 1955. 23p. Contract N7-onr-295, T. O. II, Technical Report No. 40.

The activation energy for creep of high-purity aluminum in the range from 430 to 470°K was redetermined by a new technique involving abrupt changes in temperature. Over strains from about 0.01 to about 0.40 and over stresses from 580 to 3,540 psi, the activation energy for creep was found to be 32,200 ± 1,770 calories per mole. These data disqualify the Becker-Orowan and the Kauzmann-Dushman-Seitz models for high-temperature creep and suggest that high-temperature creep might arise from a dislocation climb process. (auth)

2734 NYO-3497
Arcos Corp.
THE WELDING OF TYPE 347 STEELS. WELD QUALIFICATION TESTS ON MODIFIED TYPE 347 WELDING ELECTRODES. L[orin] K. Poole. Nov. 7, 1954. 67p. Contract AT(30-1)-1233.

Five Type 347 electrode compositions and a Type 308L composition were subjected to a series of qualification tests to ascertain their commercial usability. Three of the electrode compositions gave weld deposits which were completely austenitic. Two partially ferritic electrodes, representing standard Type 347 compositions were included for comparison. The sixth was a non-columbium Type 308L electrode having a nominal derrite content. The tests involved overlay welds, fillet welds in all positions, a restrained butt weld, and a simulated horizontal fixed position pipe weld. Though all electrodes were found commercially usable, the partially ferritic Type 347 electrodes gave the most uniform and reliable performance. (auth)

2735 NYO-6324
Pittsburgh Univ.
APPLICATION OF CHEMICAL THERMODYNAMICS TO THE STUDY OF ALLOY FORMATION. PROGRESS REPORT FOR OCTOBER 1, 1954 TO JANUARY 1, 1955. W. E. Wallace, R. S. Craig, T. D. Brotherton, W. V. Johnston, S. Kamath, C. A. Krier, and K. Sterrett. Jan. 7, 1955. 11p. Contract AT-(30-1)-647.

Further efforts to produce a precision adiabatic specific heat calorimeter for operation between 25 and 300°C are described. An account is also given of equipment constructed for automatic control of the shield in adiabatic specific heat calorimetry. Mention is made of the completion of a novel adiabatic specific heat calorimeter for use between 4 and 20°K. The latter instrument was constructed in connection with another program but is available for future use in this program. X-ray-diffraction studies have revealed the cause of the slow equilibration times in the earlier heat capacity studies of the $MgCd_3$ superlattice. The entropy of potassium at 25°K is 15.38 ± 0.03 e.u./g. atom. Present status of the heat capacity work on the intermediate phase Na_2K is given. A means for evaluating the entropies of fused Na–K alloys is mentioned. (auth)

2736 OSR-TR-55-4
Armour Research Foundation
A STUDY OF A FAMILY OF LAVES-TYPE INTERMEDIATE PHASES. Rodney P. Elliott. Dec. 20 1954. 27p. Contract AF18(600)-642, Final Technical Report No. 2.

Research investigations reported in Technical Report No. 1 of this contract indicated, on the basis of study of binary Laves-type structures, that the valencies of the first transition series increase and decrease as the atomic number increases from titanium to nickel. On the basis of miscibility regions between binary Laves-type phases, it has been possible to calculate the valencies of this transition series. Contrary to the findings of the first Technical Report, valencies are found to decrease continuously from titanium to nickel. Calculations were made using the valency of titanium as a parameter. Evidence is cited to substantiate the best values of the valencies as calculated for an assumed valency of four for titanium. (For preceding report in series see OSR-TN-54-247.) (auth)

2737 S and T Memo-6/54
Bristol Aeroplane Co., Ltd. (England)
REPORT ON THE TUNGSTEN ARGON-ARC WELDING OF MAGNESIUM–ZIRCONIUM ALLOYS. AN INVESTIGATION INTO THE USE OF MAGNESIUM–ZIRCONIUM ALLOYS IN SHEET AND PLATE FORM. Apr. 1954. 106p. Contract 6/Aircraft/5550/CB6(B).

Provided welds in magnesium alloys produced by argon-arc welding under correct conditions are proved by radiography to be free from harmful defects, they have been shown to possess a consistency of static tensile properties significantly superior to that previously obtained in hand-welding of any type of material. The level of static tensile weld strength was found to vary with material form, size, and composition, but in general there was insufficient data to determine whether these variations were significant. The ranges of mean values obtained are given. Tentative design values have been quoted for sheet material, and a coefficient of variation of 9% suggested for derivation of tentative design values for welds in the other forms and compositions of material. (auth)

2738 S and T Memo-13/54
Birmingham Univ. (England)
REPORT ON PROGRESS IN THE DEVELOPMENT OF AN ALLOYING THEORY OF TITANIUM. (PROGRESS REPORT 1951–1954 OF THE TITANIUM RESEARCH PROGRAMME). Nov. 1954. 28p.

The properties of Ti and Ti alloys which have significant relationship to the electronic structure of the metal, the courses of the observed alloying behavior of the metal, and the use of the alloys as constructional materials are summarized. The physical properties of Ti are tabulated

and graphs of specific heat as a function of temperature at high and low temperatures are given. (J.E.D.)

2739 S and T Memo-14/54

Reading Univ., Reading, Berks (England)

DIFFUSION OF SOLUTE ELEMENTS IN TITANIUM. D. H. Tomlin and A. J. Mortlock. Nov. 1954. 8p.

By examining the radiations from pile-activated Ti and Ti–Cr alloy it has been found that diffusion measurements using Cr^{51} are generally feasible even when the Cr is activated in the presence of Ti. Preliminary experiments on a Ti–Cr–Ti diffusion sandwich using normal lathe sectioning techniques indicated a value of D at 1050°C of the order of 10^{-8} cm^2/sec. A new method is described which makes use of autoradiographic techniques, and which suggests that a number of diffusion coefficients corresponding to different temperatures may be determined using the same specimen. This method has been applied both to a Ti–Cr–Ti and a Ti/18% Cr–Cr–Ti/18% Cr diffusion sandwich. At a mean temperature of 1004°C the diffusion coefficient in the respective cases was found to be 23×10^{-9} and 1.5×10^{-9} cm^2/sec. (auth)

2740 WADC-TR-53-190(Pt.2)

American Electro Metal Corp.

NEW HIGH-TEMPERATURE INTERMETALLIC MATERIALS. William Arbiter. Nov. 1953. 52p. Contract AF33(616)-109. (AD-29396)

The details of the preparation and evaluation of a large number of intermetallic compounds, of some hard metal compounds and combinations of both are reported. Of the many compounds tested, those in the systems chromium–titanium and chromium–silicon show promise as potential high temperature materials in view of their excellent oxidation resistance at elevated temperatures, and particularly in the case of the chromium–titanium materials of their excellent stress-to-rupture behavior. A large number of properties have been evaluated including electrical resistivity, thermal expansion, heat shock resistance, oxidation resistance, corrosion resistance, modulus of rupture at room and elevated temperatures and stress-to-rupture behavior. Oxidation resistance and modulus of rupture have been employed as screening tests to determine whether materials should be further tested. (auth)

2741 WADC-TR-53-496

[Institute for the Study of Metals], Univ. of Chicago

[SURFACE REACTION OF METALS]. FIELD-EMISSION MICROSCOPY. Robert Gomer. Dec. 1953. 27p. Contract AF33(616)-2090. (AD-44599)

A review of field emission microscopy carried out at the University of Chicago during tenure of this contract is presented with a general introduction to this field. The results obtained are discussed in the light of present and possible future applications in the study of surface phenomena of metals. (auth)

2742 WAPD-RM-159

Westinghouse Atomic Power Div.

EXTRUSION OF ZIRCALOY 1 BY UGINE-SEJOURNET GLASS PROCESS. J. Halapatz. Mar. 30, 1953. Decl. Aug. 5, 1954. 13p. Contract AT-11-1-GEN-14.

Zircaloy 1 billets were extruded by the Ugine-Sejournet process of the Babcock and Wilcox Co., with the following exceptions: (1) after spray coating the billets were heated in a gas-fired furnace rather than in the $BaCl_2$ bath. (2) tube billet bores were machined rather than pierced, and (3) a lower melting glass blanket was used. Photos show results of the metallographic examination, and the extrusion data are tabulated. It is emphasized that evaluation of the Ugine-Sejournet process by the results obtained is unwarranted because of the above deviations from the normal process. (L.M.T.)

2743 AEC-tr-2079

AN ELECTRON MICROSCOPIC STUDY OF THE PROCESS OF CATHODIC SPUTTERING. G. V. Spivak, I. N. Prilezhaeva [Prilezsayeva], and E. A. Gruz. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 15, 409-11 (1951). 8p.

The submicroscopic structure of Al submitted to cathodic sputtering at reduced pressures of air and Ne has been studied. Electron micrographs have made it possible to visualize the mechanism of sputtering Al by ions. Electron emission takes place from the regions of cleavage between the crystals. Near the region of electron emission positive ions are formed which bombard the cleavage planes. Local heating leads to evaporation of the metal atoms. Gradually, cone-shaped figures are formed from which the principal emission of the atoms takes place. The size of the cone-shaped figures depends upon the dimensions of the crystals. In the presence of O the emission of electrons is not concentrated in the regions of cleavage, and therefore cone-shaped figures are not formed. (M.P.G.)

2744 AEC-tr-2083

PREPARATION OF METALLIC POWDERS BY IGNEOUS ELECTROLYSIS. (Préparation Des Poudres Métalliques Par Électrolyse Ignée). J. L. Andrieux. Translated by Elsie Qualls from Rev. mét. 45, 49-59(1948). 25p. (AEC-tr-2083)

The use of the electrolysis of fused salts for obtaining metallic powders has been investigated. It was found that many metals, alloys, and metallic compounds could be prepared by this method. A serious disadvantage of the method is the difficulty of extracting and isolating the cathodic product. Techniques for solving this problem are suggested. The selection of electrolytes, the mechanism of electrolysis, and the effect of current density on the formation of crystals are discussed. (M.P.G.)

2745

RESEARCH POINTS WAY TO NEW METHODS OF PREVENTING GALLING AND SEIZING. PART I. E. S. Machlin (Columbia Univ., New York). Iron Age 175, No. 6, 91-3(1955) Feb. 10.

2746

RESEARCH POINTS WAY TO NEW METHODS OF PREVENTING GALLING AND SEIZING. PART II. E. S. Machlin (Columbia Univ., New York). Iron Age 175, No. 7, 104-6(1955) Feb. 17.

2747

EFFECT OF OXIDATION IN THE HEATED STATE ON THE SURFACE CHEMICAL COMPOSITION OF AN ALLOY OF NICKEL-CHROMIUM-TITANIUM-ALUMINUM. Frima Malamand and Georges Vidal. Compt. rend. 240, 186-8 (1955) Jan. 10. (In French)

2748

ON THE EUTECTIC TRANSFORMATION OF A COPPER-6% BERYLLIUM ALLOY. Arunachala Viswanathan. Compt. rend. 240, 626-8(1955) Feb. 7. (In French)

Experiments on a Cu-6% Be alloy show, by tempering at 750°C, a new intermediate cubic centered phase which disappears by annealing. These results emphasize the complexity of phenomena that are produced below the eutectoid temperature. (tr-auth)

2749

HYDROGEN AFFECTS CRITICAL PROPERTIES IN COMMERCIAL TITANIUM. H. D. Kessler, R. G. Sherman (Titanium Metals Corp. of America, Henderson, Nev.), and J. F. Sullivan (Allegheny Ludlum Steel Corp., Watervliet, N. Y.). J. Metals 7, 242-6(1955) Feb.

A hydride phase of Ti precipitates from the alpha solid solution as plates at slow cooling rates and is a fine dispersion upon quenching. The effect of H on the mechanical properties of α-Ti decreases the notch toughness without effecting tensile properties. It was found that the detrimental effects of H on notched toughness can be alleviated by vacuum annealing to remove H or by quenching through the precipitation range. The presence of Fe as an impurity in Commercial Ti stabilizes a small amount of retained beta phase to room temperature. (auth)

2750

GENERAL PHYSICAL METALLURGY OF TITANIUM REVIEWED. Robert I. Jaffee (Battelle Memorial Inst., Columbus, Ohio). J. Metals 7, 247-52(1955) Feb.

2751

A STUDY OF THE ROOM TEMPERATURE FATIGUE PROPERTIES OF MOLYBDENUM. W. L. Bruckart and W. S. Hyler (Battelle Memorial Inst., Columbus, Ohio). J. Metals 7, 287-90(1955) Feb.

The powder metallurgy and arc-cast types of wrought molybdenum stock were studied in rotating beam fatigue. Endurance ratios of unnotched specimens after 5×10^7 cycles were found to be 0.74 and 0.81, respectively. Fatigue notch factors (K_f) of 1.36 and 2.05, respectively, were obtained on V-notched specimens having a theoretical stress-concentration factor $K_t = 3.1$. (auth)

2752

MOLYBDENUM DEPOSITION ON TITANIUM. Sam Tour, Andre Styka, and George Fischer (Sam Tour and Co., Inc., New York). J. Metals 7, 291-6(1955) Feb.

The results obtained during research work involving coating titanium alloys with molybdenum by vapor-deposition methods are described. Results show that the method can be used successfully to deposit hard adherent wear-resistant coatings of metallic molybdenum on titanium alloys without changing the microstructure of the titanium base. (auth)

2753

CONTINUOUS MULTISTAGE SEPARATION BY ZONE-MELTING. W. G. Pfann (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Metals 7, 297-303(1955) Feb.

A simple method of obtaining multistage batch separations by crystallization was described recently. Known as zone-refining, it comprises passing short molten zones through a long solid charge. This technique can now be used on a continuous basis by means of the zone-void method described in this paper. Feed enters, at an intermediate point, a column down which molten zones travel, and waste and product leave at the ends. Materials move in the column through the agency of voids, which are introduced at the ends and travel toward the feed inlet. The voids and molten zones are moved by external heaters in a simple manner, and the principle of reflux is utilized. (auth)

2754

AN EVALUATION OF DISSOCIATED AMMONIA AND HYDROGEN ATMOSPHERES FOR SINTERING STAINLESS STEEL. Herbert S. Kalish and Edmund N. Mazza (Sylvania Electric Products Inc., Bayside, N. Y.). J. Metals 7, 304-10 (1955) Feb.

The effect of sintering types 302, 302B, and 430 stainless steel powder compacts in hydrogen and dissociated ammonia was investigated. It was found that sintering in dissociated ammonia resulted in as much as 0.5% increased in the nitrogen content of stainless steel even through the dissociation of the gas was complete. Sintering in hydrogen, on the other hand, reduced the nitrogen content of the stainless steel to less than 0.01 wt%. In the case of the 302-type stainless steel, the low nitrogen content resulted in a material that was largely ferritic, whereas the high nitrogen content rendered the material fully austenitic. Sintering in dissociated ammonia resulted in lower density, generally lower tensile strength, less ductility, and higher hardness than sintering under equivalent conditions in hydrogen. The reduction of oxides on both stainless steel and iron particles was found to be effected by hydrogen partial pressure in the sintering atmosphere. Compacting pressure was found also to effect oxide reduction during sintering. (auth)

2755

RELATION OF STRENGTH, COMPOSITION, AND GRAIN SIZE OF SINTERED WC-Co ALLOYS. J. Gurland and P. Bardzil (Firth Sterling Inc., Pittsburgh, Penna.). J. Metals 7, 311-15(1955) Feb.

An experimental study of the variation of transverse-rupture strength with composition and grain size has shown that the strength reaches a maximum for values of the mean free path between carbide particles of 0.3 to 0.6μ. The fracture originates in and proceeds through the carbide grains mainly. Impact strength and hardness also were recorded. (auth)

2756

A STUDY OF THE MICROSTRUCTURE OF TITANIUM CARBIDE. Herman Blumenthal and Ronald Silverman (American Electro Metal Corp. Yonkers, N. Y.). J. Metals 7, 317-22(1955)

It was found that despite the similarity of chemical analyses of different titanium carbides used as base materials for cermets, the physical properties, especially transverse-rupture strengths, of test bars were different. Hence this metallographic study attempts to link physical properties to microstructures. It is shown that microstructure, grain shape, and grain growth are functions of three interrelated factors: (1) powder production procedure, (2) surface conditioning of the particles, and (3) impurities either contained in the original powder or acquired during ball milling. An explanation is offered for the "coring effect," long observed, but heretofore of unknown origin. The explanation is based on assumption of an oxide film and on chemical analyses which substantiate these findings. (auth)

2757

HIGH TEMPERATURE VACUUM ETCHING ON PURE TITANIUM. W. D. Bennett (Dept. of Mines and Technical Surveys, Ottawa, Ont., Canada). J. Metals 7, 322 (1955) Feb.

It was found possible to etch polished metallographic specimens of Ti between room temperature and 1000°C without contamination or increase in hardness. (J.E.D.)

2758

ISOEMBRITTLEMENT IN CHROMIUM AND MOLYBDENUM ALLOY STEELS DURING TEMPERING. Gopalkrishna Bhat and Joseph F. Libsch (Lehigh Univ., Bethehem, N. Y.). J. Metals 7, 330-5(1955) Feb.

Isoembrittlement curves depicting the influence of time and temperature in the range 800 to 1260°F (425 to 680°C) on the development of embrittlement in a commercial chromium alloy steel and a commercial molybdenum alloy steel are presented. Two distinct regions of embrittlement occur in the chromium alloy steel: (1) at 800 to 1000°F (425 to 540°C) and (2) in the region just below the lower critical temperature. Embrittlement is most pronounced at 800 to 1000°F, decreasing very rapidly with increasing temperature above this region, only to increase again as the lower critical temperature is approached. The data suggest two distinct modes of embrittlement with possible superposition of the two modes at extended embrittling times in the temperature range 1100 to 1150°F (590 to 620°C). While the molybdenum alloy steel shows little susceptibility to embrittlement at 800 to 1000°F (425 to 540°C), considerable embrittlement may occur just below the lower critical temperature. (auth)

2759

OXIDATION OF COBALT METAL. R. E. Carter (Dept. of Mines and Technical Surveys, Ottawa, Ont., Canada), F. D. Richardson (Royal School of Mines, London, England), and C. Wagner (Massachusetts Inst. of Tech., Cambridge). J. Metals 7, 336-43(1955) Feb.

By means of inert markers of radio-platinum, it has been shown that cobalt metal oxidizes by outward diffusion of cobalt atoms through the oxide. Oxidation rates have been measured at various temperatures and oxygen pressures and have been found to agree with the rates calculated from the Wagner equation and the authors values for the diffusion coefficient of cobalt in the oxide. The distribution of radio-cobalt in growing oxide layers has been accurately measured and found to be different from that predicted from the Wagner oxidation theory. Attempts have been made to measure the change of lattice parameter of the oxide with composition. (auth)

2760

MAGNESIUM-RICH CORNER OF THE MAGNESIUM-LITHIUM-ALUMINUM SYSTEM. J. A. Rowland, Jr., C. E. Armantrout, and D. F. Walsh (Bureau of Mines, Rolla, Mo.). J. Metals 7, 355-9(1955) Feb.

The magnesium-rich corner of the 375, 200, and 100°C isothermal sections of the Mg–Li–Al system as developed by metallographic and x-ray diffraction studies is presented. (auth)

2761

PRELIMINARY INVESTIGATION OF THE SYSTEM Ti-Mg. J. W. Fredrickson (Dow Chemical Co., Midland, Mich.). J. Metals 7, 368(1955) Feb.

Alloying in this investigation was accomplished by sheath-rolling compressed compacts. All heat treating was conducted in a protective atmosphere by encapsulating the specimens in fused silica ampules under a partial pressure of He. A constitution diagram was obtained for the Ti–Mg system up to 1.5% Mg. Indications are that the addition of Mg to Ti tends to stabilize the β phase. (J.E.D.)

2762

CRYSTAL STRUCTURE AND SOME PROPERTIES OF THE COMPOUND, Zr_3Al. J. H. Keeler and J. H. Mallery (General Electric Co., Schenectady, N. Y.). J. Metals 7, 394 (1955) Feb.

2763

DECOMPOSITION OF BETA TITANIUM. Franz R. Brotzen (Rice Inst., Houston, Tex.), Edward L. Harmon, Jr., and Alexander R. Troiano (Case Inst. of Tech., Cleveland, Ohio). J. Metals 7, 413-19(1955) Feb.

Precipitation processes leading to drastic property changes are a frequent occurrence in titanium alloys containing large amounts of the retained high temperature β phase. In order to establish the kinetics and nature of these precipitation processes, a series of Ti-V alloys was studied. Time-temperature-transformation diagrams were obtained for 12.5 and 15% V-Ti alloys. These diagrams consisted of two intersecting C-shaped curves: one in the high temperature region for the equilibrium transformation $\beta \rightarrow \alpha + \beta$, and another at lower temperatures depicting the formation of the metastable transition phase, ω. Presence of the transition phase retarded the precipitation of the equilibrium α phase. Deformation of retained β resulted in the formation of the ω phase. Reversion and retrogression phenomena of the transition phase were observed. A negative temperature coefficient of resistance was found in quenched alloys containing from 15 to 20% V. (auth)

2764

A CALORIMETRIC INVESTIGATION OF THE ENERGY RELATIONS IN ALLOYS OF COMPOSITION Cu_3Au. L. R. Rubin, J. S. Ll. Leach, and M. B. Bever (Massachusetts Inst. of Tech., Cambridge). J. Metals 7, 421-3(1955) Feb.

The energies of formation of ordered and disordered solid solutions of composition Cu_3Au and the energy of ordering in this alloy were determined by tin solution calorimetry. The degree of order was measured by x-ray diffraction and electrical resistance and microhardness measurements were made on ordered and disordered specimens. (auth)

2765

METALLOGRAPHIC TECHNIQUES FOR Cu-Au ALLOYS. Robert Bakish and William D. Robertson (Yale Univ., New Haven, Conn.). J. Metals 7, 424(1955) Feb.

2766

SOME OBSERVATIONS RELATING TO THE "WETTING" OF TITANIUM WITH MERCURY. H. W. Worner (Univ. of Melbourne, Australia). J. Inst. Metals 82, 147-8(1954) Aug.

2767

THE CONSTITUTION OF THE SYSTEM SILVER–LITHIUM. W. E. Freeth and G. V. Raynor (Univ. of Birmingham, England). J. Inst. Metals 82, 569-74(1954) Aug.

The system silver–lithium has been examined by the methods of thermal analysis, metallography, and x-ray diffraction. The equilibrium diagram differs considerably from that previously accepted. The liquidus curve falls relatively smoothly from the freezing point of silver to a eutectic at 89.2 at.% lithium and 145.5°C. The lithium-rich branch of the liquidus curve rises smoothly from the eutectic point to the freezing point of lithium. The determination of the solidus curve, annealing and quenching experiments, and x-ray investigations together reveal that the solubility of lithium in silver (α) is extensive (46.6 at. % lithium at room temperature) and that four intermediate phases exist. The β phase is formed from α by a solid-state reaction or by the reaction $\alpha \rightleftharpoons \beta$ + liq. (317°C), according to composition. The γ_3 phase is similarly formed by a reaction in the solid state from β, or by the reaction $\beta \rightleftharpoons \gamma_3$ + liq. (164°C). At 154°C, γ_3 and the liquid react together to form γ_2. At higher lithium contents,

the γ_1 phase is formed in the solid state. The β, γ_3, γ_2, and γ_1 phases respectively include the compositions AgLi, Ag_4Li_9, Ag_3Li_{10}, and $AgLi_{12}$. The crystal structure of β is body-centered cubic (cesium chloride type), while the structures of γ_3, γ_2, and γ_1 are of the γ-brass type. The results are briefly discussed. (auth)

2768

THE SYSTEMS MAGNESIUM–LITHIUM AND MAGNESIUM–LITHIUM–SILVER. W. E. Freeth and G. V. Raynor (Univ. of Birmingham, England). J. Inst. Metals 82, 575-80(1954) Aug.

The system magnesium–lithium has been re-examined by thermal and metallographic methods, and it has been confirmed that there is a maximum on the β liquidus 29.0 to 29.4 at.% lithium, 594°C). The invariant reaction involving the magnesium-rich solid solution (α), β, and the liquid is therefore a eutectic reaction (588°C). Detailed study of the form of the $(\alpha + \beta)/\beta$ boundary shows that although the boundary is almost vertical from 100°C (29.9 at.% lithium) to 500°C (29.0 at.% lithium), it bends sharply towards lower lithium contents above 500°C and intersects the liq. $\rightleftharpoons \alpha + \beta$ eutectic horizontal at 24.5 at.% lithium. Metallographic experiments were carried out on the magnesium–lithium–silver system, with special reference to the form of the $(\alpha + \beta)/\beta$ phase boundary, at temperatures between 208° and 500°C. Isothermal diagrams indicate that the ternary β phase enters into equilibrium with α, Mg_3Ag, and MgAg. At 495°C β and liquid coexist, and experiments at 500°C indicate that approximately 20 at. % silver dissolves in β at this temperature. A wide solid solution of lithium in MgAg is also indicated by the various phase boundaries determined. The results are briefly discussed. (auth)

2769

INFLUENCE OF GOLD DEFORMATION ON THE YOUNG'S MODULUS OF SOME NON-FERROUS METALS. Maurice Cook, T. Ll. Richards, and G. F. Bidmead (Imperial Chemical Industries, Ltd., Birmingham, England). J. Inst. Metals 83, 41-7(1954) Oct.

Youngs modulus values of copper, brass, and aluminum after increasing amounts of cold work, principally by rolling, were determined and correlated with microstructural and x-ray observations, as well as with results of earlier investigations. (auth)

2770

THE SOLID SOLUTION OF CADMIUM IN ZINC. J. R. Brown (G.K.N. Group Research Lab., Wolverhampton, England). J. Inst. Metals 83, 49-52(1954) Oct.

The course of the solid-solubility curve of cadmium in zinc has been followed by measurement of the lattice parameters of quenched alloys. The solid solubility at the eutectic temperature is found to be 1.07 at.% (1.83 wt.%), compared with 1.23 at.% (2.10 wt. %) reported by earlier workers. The partial molal energy and entropy of solution have been calculated from the experimental results and found to be 6915 cal. and 3.88 cal. $deg.^{-1}$, respectively. (auth)

2771

TWINNING AND UNTWINNING IN POLYCRYSTALLINE MAGNESIUM. R. L. Woolley (St. Andrews Univ., Fife. England). J. Inst. Metals 83, 57-8(1954) Oct.

Some aspects of the stress/strain curve of polycrystalline pure magnesium in shear have been studied for cycles of strain amplitude less than 10%. A qualitative explanation in terms of twinning and untwinning processes is given, and is supported by the results of microscopic observation. Special attention is paid to the magnitude of the Bauschinger effect, and also to a characteristic "step" which appears in the stress/strain curve when the material is taken through a cycle consisting of a strain of the order of 10%, followed by a strain in the reverse direction and then a further larger strain in the original directions. (auth)

2772

VAPOR-SOLID EQUILIBRIA IN THE TITANIUM–OXYGEN SYSTEM. Warren O. Groves, Michael Hoch, and Herrick L. Johnston (Ohio State Univ., Columbus). J. Phys. Chem. 59, 127-31(1955) Feb.

The vaporization of TiO, Ti_2O_3, Ti_3O_5, and TiO_2 has been studied by the Knudsen effusion method, and the solid phases investigated by high temperature x-ray diffraction technique. TiO, TiO_2 (rutile), and Ti_2O_3 do not undergo any structural change up to their melting points. Ti_3O_5 has a low temperature structure and a high temperature structure (above 1600°K.). TiO(s) vaporizes to TiO(g), $\Delta H_0^\circ = 134.6$ kcal/mole, TiO_2(s) to TiO_2(g), $\Delta H_0^\circ = 138.9$ kcal/mole. Ti_2O_3 decomposes on vaporization to TiO(g) + TiO_2(g), the heat of reaction being $\Delta H_0^\circ = 296.0$ kcal/mole. (auth)

2773

FORMATION ENERGY OF SUPERLATTICE IN Ni_3Fe (III). KINETICS OF THE SUPERLATTICE AT THE FORMATION STAGE WITH LONG RANGE ORDER. Shūichi Iida (Univ. of Tokyo, Japan). J. Phys. Soc. Japan 10, 9-22(1955) Jan.

The superlattice formation of Ni_3Fe in steady temperature annealings (at 500°, 480°, and 460°C) was studied by direct observation of the heat of evolution and by measurement of specific heat on heating after each treatment. The multiple-step character of formation process of this superlattice disappeared gradually by lowering the temperature of anneal. All results are plotted on the same internal energy-temperature plane. The diagram is well explained by our theoretical treatment of the process which divides the process into two steps, with and without the long range order. But there was found a process of the third type, which remains after the second process has been completed. This becomes more distinct when the annealing temperature is lowered. For instance, when the disordered specimen was rapidly cooled to 460°C, and annealed at this temperature, it was observed that the development of order looks as though it reaches an apparent saturation after about 80 hours annealing. But, measurements of specific heat on heating of the corresponding specimen showed that the internal energy of the specimen is about 170 cal/atom higher than that of true equilibrium state at 460°C. This type of process, which has a relaxation time of the order of a month, will presumably be related to the antiphase problem. The nucleation and antiphase problems in superlattice are also discussed. The specimen which was quenched from 700°C shows an anomalous generation of heats between 230°C and 420°C on heating. This will be an important phenomenon for the formation process of this superlattice. (auth)

2774

SUPER PURITY ALUMINIUM. PRODUCTION, PROPERTIES AND APPLICATIONS. E. E. Spillett (British Aluminium Co., Ltd.). Metallurgia 51, 59-64(1955) Feb.

2775

ALUMINIUM AND ITS ALLOYS IN 1954. SOME ASPECTS OF RESEARCH AND TECHNICAL PROGRESS REPORTED. E. Elliott. Metallurgia 51, 65-74(1955) Feb.

Attention is drawn to work published in the U. K. and the U.S.A. reporting research and technical progress in the

various aspects of the metallurgy of aluminium and its alloys, including extraction, founding, fabrication, constitution and properties. Reference is also made to interesting applications of these materials. 125 references. (auth)

2776

TESTING HEAT TRANSFER AND CORROSION OF GLOBE-IRON FOR FUEL CLADDING IN A Na-COOLED FAST BREEDER. R. H. Jones (Hartford Electric Light Co., Conn.) and R. E. Lee (Mine Safety Appliances Co, Callery, Penna.). Nucleonics 13, No. 2, 70-2(1955) Feb.

Heat transfer and corrosion tests show that Globeiron, an iron alloy, is satisfactory as a thin-walled fuel-cladding material for 30-day exposures in a Na-cooled fast reactor. The tests simulated reactor operation. The testing apparatus is described, and data and results are presented. Tests indicated that Globeiron maintained its original over-all heat-transfer coefficient throughout a 30-day period and that there was no fouling of the heat exchanger due to mass transfer in the Na loop. Metallurgical examinaion showed no significant attack on the Globeiron specimen. (M.P.G.)

2777

ENERGY LEVELS OF A DISORDERED ALLOY. R. H. Parmenter (RCA Labs., Princeton, N. J.). Phys. Rev. 97, 587-98(1955) Feb. 1.

A study is made of the one-electron energy levels of a disordered alloy by means of perturbation theory, extending the results of Nordheim and Muto. To the accuracy of first-order perturbation theory, a disordered alloy is equivalent to a particular perfect crystal, the "virtual crystal," as was shown by Muto. For a certain rather general model, the effects of second-, third-, and fourth-order perturbation theory upon this "virtual-crystal" approximation are analyzed. The question of convergence of the perturbation approach is studied. A certain basic limitation of the perturbation approach is discussed, namely, the limitation to nonlocalized states. Accurate results obtained by Landauer and Helland for a hypothetical one-dimensional alloy are compared with results obtained by perturbation theory. It is pointed out that the same approach can be used with equal validity in discussing not only disordered alloys but also other types of imperfect crystals; e.g., imperfections resulting from dislocations. The most striking prediction of perturbation theory, i.e., the "tailing-off" of the density-of-states curve into a forbidden band, appears to have some experimental verification. (auth)

2778

DEFORMATION FAULTS IN COLD-WORKED METALS. G. B. Greenough and E. M. Smith (Royal Aircraft Establishment, Farnborough, Hants, England). Proc. Phys. (London) B68, 51-2(1955) Jan.

Paterson (J. Appl. Phys. 23, 805, (1952)) discussed the effect of the deformation faulting of a.f.c.c. lattice on the diffraction lines from crystals so faulted, showing that both the breadths and positions of the diffraction lines are affected to a degree depending on the particular hkl diffraction line. A discussion is presented in this note of experiments carried out on annealed and cold-worked Al alloy and Cu specimens in which only the changes in position of the lines were studied. Results fit well the postulate that, in addition to producing deformation faults, cold-working causes a change of the true lattice parameter. (L.M.T.)

2779

MACHINABILITY RESEARCH WITH J AND L TOOL DYNAMOMETER ON TITANIUM 150A. Leif Fersing and D. N. Smith (Jones and Lamson Machine Co., Springfield, Vt.). Trans. Am. Soc. Mech. Engrs. 77, 65-78(1955) Jan.

The dynamometer permits the measurement of the three component loads, the tangential, the feed, and the radial, on a tool in cut, data which when recorded continuously and permanently, give reliable and helpful information for successfully machining Ti-150A. (auth)

2780

DETERMINATION OF THE THERMAL CONDUCTIVITY OF MOLTEN LITHIUM. Henry A. Webber, David Goldstein, and Robert C. Fellinger (Iowa State Coll., Ames). Trans. Am. Soc. Mech. Engrs. 77, 97-102(1955) Feb.

Conductivity coefficients for 99.8% pure lithium were measured over the range 420 to 1002°F. Lithium showed a value of 26 and 18 Btu/hr sq ft deg F/ft at 420 and 1002°F, respectively. Measurements based on an absolute heat input proved unreliable. The results were based on a temperature gradient measured in an Armco iron heat sink, the thermal conductivity of which appears in the published literature. The estimated error of the results was ± 10%. (auth)

2781

BRAZING MOLYBDENUM FOR HIGH-TEMPERATURE SERVICE. M. I. Jacobson and D. C. Martin (Battelle Memorial Inst., Columbus, Ohio). Welding J. (N. Y.) 34, 65s-74s(1955) Feb.

Sixteen brazing alloys with melting points ≥ 1800°F were studied as to ability to wet Mo, brazing techniques required for good joints, and properties of brazed joints in commerical Mo at room and 1800°F temperature. Methods investigated included vacuum brazing in an Inconel retort, oxyacetylene torch brazing with a flux and induction brazing in vacuum and in argon. Induction brazing in argon was the most satisfactory method from the standpoints of braze quality and practicability. The best Co-base brazing alloy was Haynes Alloy 25 and the best noncobalt-base alloy was Inconel. (L.M.T.)

2782

AGE-HARDENING OF ALUMINUM-SILVER ALLOYS IN THIN LAYERS. Albert Winkelmann. Z. angew. Phys. 7, 7-12(1955) Jan. (In German)

2783

THE REACTION OF METALLIC TITANIUM, ZIRCONIUM, HAFNIUM, AND THORIUM WITH ACIDS, ESPECIALLY WITH HYDROFLUORIC ACID. M. E. Straumanis and J. I. Ballass. Z. anorg. u. allgem. Chem. 278, 33-41(1955) Jan. (In German)

Of the four metals Ti, Zr, Hf, and Th, Th is the most resistant to the action of acids. It dissolves very slowly, probably with the formation of tetravalent ions in HF, HCl, and H_2SO_4. Aqua regia, in comparison, works most rapidly. The action of other acids is rapid or completely ineffective. The behavior of the first three metals in the different acids is very similar. They dissolve rapidly in HF and also in diluted acids with the evolution of H. (tr-auth)

TRACER APPLICATIONS

2784

TRITIUM DETERMINES MOISTURE GRADIENT IN ATTACHED PROTECTIVE COATINGS. G. D. Calkins, M. Pobereskin, V. E. Young, and L. J. Nowacki (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 13, No. 2, 76-7(1955) Feb.

The penetration of moisture in varnish films has been

studied using tritium as a tracer. A uniform clear varnish film on a steel disk was exposed to tritiated-water vapor. Uniform film layers were successively removed, and the radioactivity of each new surface was determined. The procedure appears to be satisfactory and is described in detail. It was found that moisture completely penetrates a 1.5 mil thick varnish film in less than an hour. (M.P.G.)

PHYSICS

2785 AD-24936

California Inst. of Tech.

TABLES OF BOND AND RESONANCE ENERGIES FOR ESTIMATING STANDARD HEATS OF FORMATION (thesis). Wilbur F. Offtermatt. 1953. 79p.

Tables of bond and resonance energies have been redetermined by using the most recent thermochemical data available. The use of the data is illustrated for the calculations of standard heats of formation of chemical compounds, including propellants. (auth)

2786 AD-28429

Electrical Engineering Research Lab., Engineering Experiment Station, Univ. of Ill.

ELECTRICAL LOSSES IN CERAMIC-TO-METAL SEALS. E. W. Ernst and O. T. Purl. Feb. 1954. 46p. Contract AF19(604)-524, Technical Report No. 2.

The effective resistance of interface material between metal-ceramic seals was measured for high frequencies. (K.S.)

2787 BNL-2113

Brookhaven National Lab.

OCCURRENCE OF TECHNETIUM-98 IN NATURE. Edward A. Alperovitch and J. Malcolm Miller. Columbia Univ. and Brookhaven National Lab. [1954]. 8p.

The discovery of Tc in the sun and in S-type stars has encouraged a new search for a stable or long-lived naturally-occurring Tc isotope. Tc^{98} cannot be stable, but its half life is expected to be $> 10^7$ yrs. Experiments have been started to detect Tc^{98} directly by means of neutron activation analysis, since Tc^{99m} with a half life of 6 h is formed from neutron capture by Tc^{98}. A procedure to isolate submicrogram amounts of Tc from macro quantities of other elements has been developed by a combination of ion-exchange chromatographic and distillation techniques. Of 12 samples examined, 6 gave positive and 2 gave negative results. The 4 remaining cases were uncertain. In most cases the formation of activity from Mo could be ruled out with sufficient certainty to leave the (n,γ) process on naturally occurring Tc^{98} as the most plausible explanation. All alternative processes must be rigorously ruled out before the presence of Tc^{98} in nature may be regarded as established. (M.P.G.)

2788 ISC-380

Ames Lab.

ELECTRICAL PROPERTIES OF CRYSTALLINE BORON. W. C. Shaw, D[onald] E. Hudson, and G. C. Danielson. Aug. 1953. 152p. Contract W-7405-eng-82.

The boron crystals used in this study were prepared by reducing boron tribromide with hydrogen upon contact with a hot (1500°C) tantalum filament. The largest single crystals weighed less than ten micrograms and were a few hundred microns in length. The high purity of the specimens was verified spectrographically and their crystalline nature was verified by means of Laue photographs. Micromanipulative techniques for mounting very small crystals with several electrical contacts were developed. Microscopic single crystals of boron were mounted with as many as five spring loaded tungsten probes. Measurements were made of voltage-current characteristics, resistivity, and Hall and thermoelectric effects as functions of temperature. Qualitative studies were made of rectification, forming, and photoconductivity. The voltage current characteristics of crystalline boron were explained in terms of joule heating. The resistivity of crystals typical of the majority of those tested was found to be approximately 1.7×10^6 ohm cm at 25°C. The resistivity of a typical crystal decreased by a factor of almost 10^{10} between the temperatures of 200 and 1000°K. From resistance data obtained in the temperature range between 700 and 1000°K the intrinsic energy gap Eg between the filled and conduction bands was computed to be about 1.55 ev. Hall, thermoelectric, and rectification studies showed the purest specimens of crystalline boron were predominately p-type. It was found that heat treatment could convert typical p-type boron crystals into relatively low resistivity n-type crystals. Hall effect measurements were made on one such heat-treated crystal and on another low resistivity n-type crystal selected on the basis of qualitative thermoelectric measurements. From these Hall effect data the mobility of electrons in these particular crystals of boron was calculated to be about 0.7 cm^2/volt sec. From Hall effect data obtained on a typical crystal the mobility of holes was calculated to exceed that of electrons by about 0.2 cm^2/volt sec. The effective masses of the carriers were calculated to exceed ten electron masses and the mean free paths of the carriers to be between one and one hundred minimum interatomic distances. (auth)

2789 K-1186

Carbide and Carbon Chemicals Co. (K-25)

MOVEMENT OF MATERIAL ON OSCILLATING TRAYS. D. W. Burton. Dec. 30, 1954. 13p. Contract W-7405-eng-26.

One way to convey materials is to place them upon an oscillating tray. In order to optimize the design of such a system, a method to predict the movement of the material on the tray is desirable. This report contains a method to predict the movement of the material in the region of sliding motion. A graph of the material movement for zero tray angle from the horizontal is included. (auth)

2790 NP-5532

Shell Development Co.

AN INVESTIGATION OF GREASE LUBRICATION PHENOMENA IN OPEN, SHIELDED AND SEALED ANTI-FRICTION BEARINGS. (Cover carries title: GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS. QUARTERLY PROGRESS REPORT NO. 1 FOR MAY THROUGH JULY 1954. J. B. Accinelli and R. C. Jones. 21p. Contract AF33(616)-2443. (S-13613)

The objective is the investigation of grease lubrication phenomena in open, shielded, and sealed antifriction bearings at DN values of 1×10^5 to 2×10^6. A description of the test equipment (rig, instrumentation, and test bearings) is presented, and some discussion of startup and performance tests is included. Preliminary results for

three greases at DN values between 0.75×10^6 and 1.0×10^6 are discussed. (L.M.T.)

2791 NP-5533
Shell Development Co.
AN INVESTIGATION OF GREASE LUBRICATION PHENOMENA IN OPEN, SHIELDED AND SEALED ANTI-FRICTION BEARINGS. (Cover carries title: GREASE LUBRICATION OF HIGH SPEED ANTI-FRICTION BEARINGS.) QUARTERLY PROGRESS REPORT NO. 2 FOR AUGUST THROUGH OCTOBER 1954. J. B. Accinelli and R. C. Jones. 30p. Contract AF33(616)-2443. (S-13624)

The new and improved high-speed rigs were completed and installed during this period. Initial breakdown tests are now in progress and after minor adjustments the rigs will be ready for use in the present program. These rigs employ a 20 mm bearing and a smaller turbine wheel which make possible higher speeds with less hazard. Efforts to find bearings suitable for operation above 1×10^6 DN were continued and two bearings were tested which appear to give satisfactory test performance up to 1.5×10^6 DN. Both bearings employ iron–silicon bronze outer-race-controlled ball separators which appear to have lower lubrication requirements than any separator design previously tested. The choice of bearing for further work will depend on cost and availability. Preliminary studies of various grease factors at DN values of 1.0×10^6 and light axial load (12 lbs) show that all grease variables (consistency, oil viscosity, oil type) play some part in bearing performance at high speed. A grease of soft consistency generates higher bearing temperatures possibly by churning. Oil viscosity seems to be a very important factor at DN values above 1.25×10^6. A bearing operating at 1.5×10^6 DN was well protected by a grease containing a heavy mineral oil while the same bearing was quickly and severely damaged at this DN when lubricated with a grease containing a light mineral oil. With respect to oil type there seems to be little difference at 1.0×10^6 DN between a diester oil and a mineral oil grease. However, a grease gelled with silicone oil failed very quickly under these conditions. As expected, increasing bearing speed increases the severity of operation. However, of particular interest is the observation made in several tests at 1.25×10^6 and 1.5×10^6 DN of the change in bearing damage at the highest DN value. Where separator wear was the primary problem up to 1.25×10^6 DN, ball-to-raceway lubrication appeared to be the most critical factor at 1.5×10^6 DN. Exploratory work on grease film centrifugation is discussed. (auth)

2792 NP-5542
Stanford Research Inst.
THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. QUARTERLY PROGRESS REPORT NO. 2 FOR SEPTEMBER 1 TO NOVEMBER 30, 1954. A[loysius] P[aul] Brady, J. K. Clauss, and Orlo E[dmund] Myers. Jan. 31, 1955. 15p. Contract AF 33(616)-2558.

Several methods for the preparation and purification of $MoBr_3$, an intermediate for MoF_3, are discussed and results are given. It was found that complex dissociation and disproportionation equilibria are involved. The best results, 97.4% purity, were obtained by heating Mo powder in a thermostatically controlled reactor. Contamination by $MoBr_4$ was eliminated by preventing its condensation in a similar heated connected condenser. With the reactor at 375°C and the condenser at 300°C, dry O_2-free N_2 gas was saturated with Br_2 vapor at room temperature and passed over the Mo metal. Procedures for gravimetric determination of Mo and Volhard determination of the bromide are presented. The detailed design, testing, and construction of a recording precision microvolt potentiometer is presented. (For preceding period see NP-5415.) (J.A.G.)

2793 NYO-6447
Massachusetts Inst. of Tech.
THE MEASUREMENT OF THERMAL CONDUCTIVITY OF REFRACTORY MATERIALS. QUARTERLY PROGRESS REPORT FOR THE PERIOD ENDING JANUARY 1, 1955. W. D. Kingery and F. H. Norton. 14p.

Additional thermal conductivity measurements have been completed for a soda-lime-silica glass, beryllia, sapphire, and fused silica. Data for fused silica and sapphire indicate that radiant heat transfer becomes important at temperatures above about 500°C. Data for fused silica do not conform to the simplest theoretical assumptions regarding temperature dependence, while data for sapphire do. Fabrication and study of polycrystalline aggregates are in progress. A study of powder and fibers has been initiated. Preliminary results of emissivity measurements are in agreement with apparatus design assumptions. (auth)

2794 ORNL-1802
Oak Ridge National Lab.
FILAMENT ACTIVATION WITH GADOLINIUM. O. C. Yonts and L. O. Love. Sept. 1, 1954. 15p. Contract W-7405-eng-26.

The degree of activation of tungsten and tantalum filaments by gadolinium is given, and a temperature determined above which this activation ceases. (auth)

2795 WADC-TR-55-30(Pt.3)
Petroleum Refining Lab., Pennsylvania State Univ. [Coll. of Chemistry and Physics]
FLUIDS LUBRICANTS, FUELS, AND RELATED MATERIALS. FINAL REPORT FOR OCTOBER 1953 THROUGH SEPTEMBER 1954. E. Erwin Klaus and Merrell R. Fenske. Nov. 1954. 339p. Contract AF33(038)-18193. (For preceding period see PRL-5.8.)

2796 AEC-tr-2084
EFFECT OF RADIOACTIVE DECAY ON THE THERMAL REGIME OF THE EARTH. E. [Ye.] Liubimova. Translated by E. R. Hope from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz. 3–14(1952). THE ROLE OF THERMAL CONDUCTIVITY IN THE THERMAL REGIME OF THE EARTH. E. [Ye.] Liubimova. Translated by E. R. Hope from Ibid. 523-5(1953). 20p. (AEC-tr-2084)

A solution of the thermal conduction equation is given for a sphere which is heated internally by radioactive sources of heat of an intensity decreasing with time. The solution, obtained by the method of reflections, is stated in terms of a rapidly converging series, which makes it possible to calculate the variation of temperature at any depth within the earth. Also given are the results of calculations of the internal temperature and the surface geothermic gradient for the case of a uniform distribution of radioactive elements throughout the volume of the earth and with the heat conductivity, thermal capacity, and density constant at all points, i.e. for a homogeneous model of the earth. (auth)

2797
A THEORY OF THERMAL DIFFUSION IN LIQUIDS. E. L. Dougherty, Jr., and H. G. Drickamer (Univ. of Illinois, Urbana). J. Chem. Phys. 23, 295-309(1955) Feb.

A theory of thermal diffusion in liquids has been developed based on Denbigh's interpretation of the "net heat of transport" which arises in the thermodynamics of irreversible processes. The thermal diffusion ratio α is expressed in terms of the energies of vaporization of the pure components, the excess energy, entropy and volume of mixing, and the concentration dependence of ΔU_e. The efficiency with which the two species pack together is also introduced. The Hildebrand-Scatchard solution theory is applied to these results and α is expressed in terms of solubility parameters, molal volumes and packing efficiencies. The equations are compared with previously published experimental results, and reasonably explainable packing efficiencies are obtained. In the appendices the effects of nonrandomness of mixing are considered and the theory is extended to ternary mixtures. (auth)

2798

THE DETERMINATION OF PARTICLE SIZE AND REFRACTIVE INDEX NEAR THE TURBIDITY MAXIMUM IN MONODISPERSE SUSPENSIONS OF SPHERICAL PARTICLES. Wilfried Heller (Wayne Univ., Detroit, Mich.). J. Chem. Phys. 23, 342-3(1955) Feb.

Theoretical values on the specific turbidity of colloidal spheres within the range of diameters of 1 to 2 microns are given. It is shown how an unambiguous particle size can be determined within this range in spite of a turbidity maximum. The latter can be determined for almost any refractive index by means of an empirical equation. An alternate turbidity maximum can be used for determining the refractive index of the light scattering material provided the diameter is known. (auth)

2799

SELF-DIFFUSION IN SODIUM NEAR THE MELTING POINT. Robert E. Meyer and Norman H. Nachtrieb (Univ. of Chicago). J. Chem. Phys. 23, 405(1955) Feb.

The rate of self diffusion in both states of Na within 0.1°C of the melting point was measured to determine whether a "pre-melting" phenomenon occurs. Results of four runs show agreement with calculated results within experimental limits. Diffusion coefficients were also measured from 98.0 to 226°C by the capillary reservoir technique, and results may be represented by the equation: $D = 1.10 \times 10^{-3} \exp(-2450/RT)$. It appears that the transition from the rate of solid-state self diffusion to the rate of liquid state self diffusion is as discontinuous in Na as the melting point, itself. (L.M.T.)

2800

DEVELOPMENT OF EMUISIONS DUE TO SELF NUCLEATION. Hiromu Wakeshima (Kobe Univ. of Mercantile Marine, Japan). J. Phys. Soc. Japan 10, 65-70(1955) Jan.

Based on the formulas for the absolute rate of self-nucleation in condensed systems and also for the growth of droplets, the process of development of emulsions in solutions supersaturated with dissolved liquid, when the meta-stable state is broken by self-nucleation, is approximately treated, in a way similar to that given previously (J. Phys. Soc. Japan 9, 400(1954)). The relations giving such as the threshold condition for the appearance of turbidity and the number density of droplets are obtained. (auth)

2801

THERMODYNAMIC PROPERTIES OF He^3 AND He^4 SOLUTIONS. V. S. Nanda (Ohio State Univ., Columbus). Phys. Rev. 97, 571-7(1955) Feb. 1.

In the present paper the thermodynamics of mixing of He^3 and He^4 solutions has been investigated on the basis of the existing theories. De Boer and Gorter's theory is modified to take account of the nonideal character of the solution above the λ temperature. The theoretical vapor pressure results are compared with Sommers' measurements at the dew point. It is found that certain features can be explained only on the de Boer-Gorter-Taconis approach. However, the incompatibility of any theory based on Taconis' hypothesis with Sommers' extensive vapor pressure measurements at fixed liquid concentrations prevents drawing any definite conclusions. Valuable information about the proper choice of the model for He^3 and He^4 solutions might, however, be obtained by an experimental study of the variation of heat of mixing and specific heat of mixing with temperature and concentration. (auth)

2802

ELASTIC SPECTRUM OF COPPER FROM TEMPERATURE-DIFFUSE SCATTERING OF X-RAYS. E. H. Jacobsen (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 97, 654-9(1955) Feb. 1.

Measurements have been made of the temperature-diffuse scattering of x rays from a single crystal of copper at 300°K by using crystal monochromated Cu Kα radiation. The measurements were analyzed by the method of Laval and James to give dispersion curves of frequency vs. wave vector for longitudinal and tranverse waves in the 100, 110, and 111 directions. These results were then expressed in terms of the generalized force constants of the Born theory of lattice dynamics. By considering the interaction of first, second, and third neighbors, nine force constants are involved, and these have been evaluated from the dispersion curves. These force constants appear in the secular equation of frequency vs. wave vector and constitute the necessary data for computing a complete vibrational frequency spectrum. Such a spectrum has been calculated from the secular equation, by machine computation, for 3417 wave vectors. From this spectrum a specific heat curve was calculated and compared with experiment in the range of 15 to 100°K. (auth)

2803

TREATMENT OF LIQUID He^3 BASED ON THE "CELL" MODEL. H. N. V. Temperley (National Bureau of Standards, Washington, D. C.). Phys. Rev. 97, 835-6(1955) Feb. 1.

2804

HIGH-ORDER FOCUSING BY A UNIFORM MAGNETIC FIELD WITH STRAIGHT-LINE BOUNDARIES. E. T. S. Walton (Trinity Coll., Dublin, Ireland). Proc. Roy. Irish Acad. A57, 1-13(1954) Nov.

A special drawing instrument has been constructed with which to study the focusing of rays of charged particles by a uniform magnetic field extending over a limited area. This instrument will draw the ideal exit boundary of the field corresponding to any arbitary entrance boundary. It has been used to determine what straight line boundaries will give the best focusing of rays diverging over as wide an angle as possible. The results have been given in graphs suitable for use in the design of sector-shaped magnetic analysers which combine large aperture with good focusing. It has been shown that these designs also give convenient and high-order focusing of particles of nearby magnetic rigidity. (auth)

2805

THE OPTICAL PROPERTIES OF THIN OXIDE FILMS ON TANTALUM. A Charlesby and J. J. Polling (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Roy. Soc. (London) A227, 434-47(1955) Feb. 8.

The iridescent colors produced at the surface of anodically oxidized tantalum have been studied spectrophotometrically. These colors result from interference, the intensity of the reflected light varying between certain maximum and minimum values according to the wave length. From measurements of the wave-lengths at which the minima occur, from 2600 to 8500A, the refractive index and its variation with wave-length are deduced. Values are 2.84 at 3000A and 2.42 at 8000A. The phase change at the metallic surface was also deduced, values being 0.2π radian at 2700A and 0.8π radian at 8000A. The thickness of the anodically formed films has been found to be 16.0A/V. (auth)

2806

FURTHER INVESTIGATIONS OF CHARGE EXCHANGE AND ELECTRON DETACHMENT. I. ION ENERGIES 3 TO 40 KEV. II. ION ENERGIES 100 TO 4000 EV. J. B. H. Stedeford and J. B. Hasted (Univ. of Coll., London, England). Proc. Roy. Soc. (London) A227, 466-86(1955) Feb. 8.

This paper describes the measurement of charge transfer cross sections for protons, molecular hydrogen ions, and helium ions in the rare gases and hydrogen, and electron detachment cross sections for negative atomic hydrogen ions in the rare gases. Part I describes the energy range 3 to 40 kev. In part II the energy range 100 to 4000 ev is described, and the results are discussed in terms of the pseudo-adiabatic hypothesis. Comparisons are made with other experimental results, and anomalous molecular cases are discussed in terms of reactions involving anti-bonding states. (auth)

2807

ANNUAL REPORT OF THE INTERUNIVERSITY INSTITUTE OF NUCLEAR SCIENCES, 1953. Interuniversity Institute of Nuclear Sciences, Brussels, 1953. 88p.

Research activities of the I.I.N.S. are reviewed. These include accelerator design and construction, radiobiology, nuclear physics, and theoretical studies. A brief history of the organization is presented with a discussion of its relationship to the European Council for Nuclear Research (CERN). (K.S.)

COSMIC RADIATION

2808 NP-5527

Indiana Univ.

THE NATURE AND INTERACTIONS OF HIGH ENERGY FUNDAMENTAL PARTICLES. TECHNICAL REPORT NO. 1 [COVERING PERIOD] JUNE 8, 1951 TO JULY 31, 1954. R. W. Thompson. 29p. Contracts DA-33-008-ORD-129 and DA-33-008-478.

Fundamental research in cosmic radiation is reported. The new heavy unstable particles which are produced in nuclear collisions of energy of the order of several bev are being studied. A magnetic cloud chamber has been used for the investigations. A description of the apparatus and the methods used in the determination of track curvature and angles are given. Among 165 observed examples of V^0 particle decay, there were 5 cases in which 2 V^0 particles probably originated in the same nuclear interaction. The cases are compatible with the production reaction tentatively proposed by a Brookhaven group: $\pi^- + p \rightarrow \Lambda^0 + \theta^0$. Good evidence has been obtained for the existence of the θ^0 particle in the V^0_2 group. The suggested decay scheme is $\theta^0 \rightarrow \pi^+ + \pi^- + 214 \pm 5$ Mev, although the decay $\theta^0 \rightarrow \pi^+ + \mu^+ + 230 \pm 5$ Mev is possible. A 3-body decay scheme appears to be difficult to reconcile with observations, unless it is assumed that the charged fragments tend to be emitted with the maximum possible kinetic energy. The observation of 2 anomalous events constitutes a reasonably firm indication that there is at least one new type of neutral particle not yet unambiguously identified or a new mode of disintegration of the θ^0 or Λ^0 particle. Additional data further substantiate the decay scheme $\Lambda^0 \rightarrow p + \pi^- + 37 \pm 1$ Mev. (M.P.G.)

2809

COSMIC RADIATION. I. W. Galbraith (Atomic Energy Research Establishment, Harwell, Berks, England). Atomics 6, 41-6(1955) Feb.

A general picture of the nature of cosmic radiation is presented, and some of the properties of the "fundamental" particles are considered, e.g., proposed decay schemes. (L.M.T.)

2810

ON THE EAST-WEST ASYMMETRY OBSERVED BY MEANS OF ISOLATED TRACKS PRODUCED BY COSMIC RADIATION. M. Morand, L. Winand, and C. Beets. Bull. soc. roy. sci. Liege, Nos. 4 and 5, 134-6(1949). (In French)

Values of the E-W asymmetry have been obtained as a function of zenith angle, from nuclear emulsions exposed at latitudes 2°S and 22°N. An analysis of the plates shows that a majority of the mesons and electrons were produced by primaries which were insensitive to the earth's magnetic field, and that few of the observed particles were caused by primaries of very high energy. (K.S.)

2811

ON THE LATITUDE EFFECT AND ITS CORRELATION WITH E-W ASYMMETRY OF THE NUCLEAR COMPONENT. Tsai-Chu. Compt. rend. 240, 300-2(1955) Jan. 17. (In French)

The curve representing the latitude effect of secondary nucleons is extended by new experimental methods. The ratio of primary and secondary vertical intensities varies from 0.6% at the equator to 0.2% at high latitudes. The value of the asymmetry calculated from the latitude effect is in agreement with observation. (tr-auth)

2812

ON A THEORY OF THE ORIGIN OF COSMIC RADIATION. Jean Heidmann. Compt. rend. 240, 618-20(1955) Feb. 7. (In French)

It is shown that the most probable energy for cosmic radiation is 10^9 ev, and that the energy cutoff and spectral form can be explained. A time variation with a period of 10^8 yr should take place. (tr-auth)

2813

ELECTRON PAIRS OF COSMIC RADIATION: MOMENT TRANSFER OF VERY HIGH ENERGY PHOTONS. Madeleine Avan and Louis Avan. J. phys. radium 16, 97-100(1955) Feb. (In French)

The theory of Heitler and Bethe, formulated within the framework of the Born approximation, is extended to high-energy electron pairs. Nuclear recoil in the positron-electron center-of-mass system and the angular relation of energy distribution are considered. (K.S.)

2814

PENETRATING SHOWERS FROM HYDROGEN AND OTHER ELEMENTS. M. Cervasi, G. Fidecaro, and L. Mezzetti (Univ. of Rome, Italy). Nuovo cimento (10) 1, 300-13(1955) Feb. (In English)

The production of penetrating showers (p.s.) in paraffin,

graphite, iron, and lead by the fast nucleons of the cosmic radiation at 3,500 m above sea level has been investigated. The apparatus consists of a large area p.s.-detector and a large hodoscope of Geiger counters; its main features as compared with the arrangements recently used by other authors, are a better angular resolution for the particles of the showers and the use of very thin production layers. The validity of the difference method to obtain the interactions in hydrogen from the comparison of the rates obtained with paraffin and carbon is discussed. From the rates obtained for hydrogen through this analysis and those found for graphite, iron and lead, the ratios of the interaction mean free paths for p.s. production are deduced. The cross-sections appear to follow closely the $A^{2/3}$ law (A = mass number), corresponding to the geometrical cross-section of the nuclei involved. Also the apparent cross-section for hydrogen is found to be little less than geometrical (60×10^{-27} cm^2), in disagreement with what was found by other authors: the discrepancy is believed to be due to the differences in instrumental bias. The rates of the p.s. which appear to be generated in hydrogen by charged and neutral primaries are compared and discussed. The experimental results do not show any striking difference between the two cases, but an interpretation in terms of the elementary cross sections for the (pp) and (np) interactions appear to be premature. (auth)

2815

INTERACTIONS OF THE HEAVY NUCLEI OF THE COSMIC RADIATION. J. H. Noon and M. F. Kaplon (Univ. of Rochester, N. Y.). Phys. Rev. 97, 769-79(1955) Feb. 1.

Fragmentation probabilities have been obtained for the interactions of heavy nuclei with target nuclei of photographic emulsion and a light element absorber (gelatin and cellulose acetate). The predictions of a simple geometrical model for the fragmentation probabilities in light elements derived from those observed in emulsion are in agreement with experimental observations. Measurements of the interaction mean free paths of heavy nuclei at different latitudes indicate that the interaction cross section is energy insensitive and is smaller than geometric. Curves are presented showing the ratio of the secondary light element (Li, Be, B) flux relative to the medium element ($6 \leq Z \leq 10$) flux as a function of atmospheric depth. (auth)

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2816

CAPACITANCE AND CONDUCTANCE EFFECTS IN PHOTOCONDUCTING ALKALI HALIDE CRYSTALS. James Ross MacDonald (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 23, 275-95(1955) Feb.

Measurements of the a-c and d-c response of illuminated F-centered potassium bromide single crystals have been carried out. The dependence of crystal capacitance and conductance on frequency, light intensity, electrode character and separation, F-center concentration, applied voltage, temperature, and optical bleaching time have been investigated. Most of the measurements were made on crystals containing both U and F centers, but a few were also made on additively colored and plain untreated crystals for comparison. It was found that F centers in U-centered crystals bleached much slower under strong illumination than did those in additively F-centered crystals. The frequency reponse of the crystals depended significantly upon whether the electrodes were blocking or rectifying, but in both cases it was characterized by a single relaxation time given by the quotient of a series capacitance C_0 and G_∞, the normal conductance of the crystal. C_0 was found to be independent of all variable parameters except dark storage and bleaching time and is thought to arise from a charge-free layer located at one or both electrodes. Space-charge capacitance effects were apparently largely hidden by C_0 but did probably produce a small voltage-dependent monlinearity observed at low frequencies with high applied voltages. G_∞, and thus the conduction-band electron concentration, depended linearly on light intensity over a wide range but underwent a transition from linear dependence on F-center concentration to independence thereof at high concentrations. Partly bleached crystals in total darkness exhibited appreciable conductivity, probably electronic in character. Most of the results on U-centered crystals can be tentatively explained in terms of electron trapping by negative-ion vacanies, F centers, interstitial hydrogen atoms, and hydrogen atoms in negative-ion vacancies. (auth)

2817

THE USE OF A HIGH-SPEED DIGITAL COMPUTER FOR THE DIRECT DETERMINATION OF CRYSTAL STRUCTURES. I. W. Cochran and A. S. Douglas (Univ. of Cambridge, England). Proc. Roy. Soc. (London) A227, 486-500 (1955) Feb. 8.

A method is described whereby an electronic computer, the EDSAC, may be used to select a set, or sets, of signs for the coefficients F(h) of a Fourier series, such that the Fourier series satisfies a certain condition. This condition is expressed as $\chi \equiv \Sigma_h \Sigma_{h'} P(h,h') S(h) S(h') S(h + h') \geq \chi_0$, where S(h) denotes the sign of F(h) and P(h, h′) is a weighting factor related to the probability that S(h) S(h′) = S(h + h′). In certain circumstances the determination of a crystal structure which is beyond the range of other direct methods is possible by this procedure. (auth)

ELECTRONS

2818

POLARIZATION ENERGY FOR 3d AND 4p ELECTRONS. R. E. Trees (National Bureau of Standards, Washington, D. C.). Phys. Rev. 97, 686-9(1955) Feb. 1.

Meshkov (Phys. Rev. 91, 871(1953)) has demonstrated the presence of an appreciable polarization energy associated with the combination of a 3d and a 4p electron in the $3d^2 4p$ configuration of Ti II. He has shown that the mean deviation between theory and experiment is reduced from ±332 to ±249 K when this energy is considered. It is noted that by use of a modified form of Meshkov's approximation a further reduction to ±180 K is produced. This modification requires only three adjustable parameters, as compared with the five required in Meshkov's original method. It is suggested that the agreement could be made even better if a breakdown of LS-coupling due to the closeness of three terms in this spectrum were considered. (auth)

2819

SUBEXCITATION ELECTRONS. Robert L. Platzman (Purdue Univ., Lafayette, Ind.). Radiation Research 2, 1-7 (1955) Feb.

The "subexcitation electrons" (free electrons produced by the absorption of ionizing radiation in molecular species) can be considered to have kinetic energy ϵ smaller than the smallest excitation energy E_0 of the molecule. Included in

this group are electrons ejected with initial energy $\epsilon \leq E_0$ by primary, secondary, etc., charged particles as well as electrons which initially had $\epsilon \geq E_0$, but subsequently suffered one or more elastic collisions. The subexcitation electrons may be characterized by their energy distribution $N(\epsilon)d\epsilon$, where the energy of each electron is taken to be that of the energy below E_0 first attained. Concern is made with deducing some features of $N(\epsilon)$ for the simplest media from certain experimental data. This aids in treating the subexcitation electrons as a more or less distinct part of the effect of the radiation. (L.M.T.)

GASES

2820 AD-14076

Vacuum-Electronic Engineering Co.

AIR IONIZATION GAUGE (DUAL IONIZATION GAUGE). FINAL RESEARCH REPORT [FOR] OCTOBER 1, 1952 TO NOVEMBER 30, 1952. REPORT NO. 390-8. Floyd R. Banks, Jr. Feb. 27, 1953. 27p. Contract AF19(122)-390.

Research on a dual ionization gage provided design details and operating techniques for a single-stage differential ionization gage for gas analysis. The proposed design consists of a septode with an indirectly heated oxide-coated cathode, a control grid for emission regulation, an electron repeller grid to provide a monoenergetic electron beam, 2 accelerating grids 4 cm apart to provide a long-path equipotential collision space, a photoelectron suppressor grid, and a collector plate. The electron repeller is operated at 2 different voltages for each setting of the accelerating grid voltage to provide the equivalent of a monoenergetic beam. These features appear useful for gas analysis in the intermediate accuracy range, particularly when a specified constituent in the presence of others is of interest. The device is limited since 2 constituents of a gaseous mixture cannot be separated if the ionization potential is the same for each, and since the significant parameter is the product of the ionization efficiency and the partial pressure of each gaseous component; a constituent of low ionization efficiency and low partial pressure cannot be detected in the presence of one with high ionization efficiency and high partial pressure. (ASTIA abst.)

2821 ISC-498

Ames Lab.

IONIZATION YIELDS OF FISSION FRAGMENTS IN GASES. Lloyd Otto Herwig and G. H. Miller. Dec. 1953. 115p. Contract W-7405-eng-82.

Fission fragment mass distributions which were derived from data obtained from double ionization chambers using argon plus CO_2 gases disagree with those obtained by means of radiochemical analysis of ths fission products. Fission fragment velocity distributions which were also derived from double ionization chamber data disagree with those obtained from a direct measurement of velocities. The ionization defect is thought to arise from energy transfer through elastic collisions and hence should be a function of the atomic mass of the gas. In this experiment it was of interest to determine whether the ionization defect of fission fragments was a function of the mass of the stopping gas. Ionization distributions were obtained for fission and α particles using a parallel-plate gridded ionization chamber employing electron collection. A natural U film was irradiated with d-d reaction neutrons to produce fission. Comparison of the most probable pulse voltages for fission fragments with those of α particles, combined with known α energies, gave the so-called fission energies. Fission energies which were measured in various gases and gas mixtures were compared with each other to determine differences in the ionization defects between gases. The ionization defects of the most probable fission fragments stopped in He, Ne, N_2, argon plus 5% N_2, and argon plus 3% CO_2 were measured relative to those of argon. Differences in the ionization defects between argon and helium gases were observed to be about one-third as large as those which were expected on the basis of increased ionizing efficiency for lighter recoil gas atoms. Large differences in the defects between argon and N_2 gases and between argon and argon plus CO_2 were observed. They were explained qualitatively in terms of a molecular ionization defect. The operating characteristics of a gridded parallel-plate ionization chamber were investigated, and the particular effects, such as electron multiplication about the grid wires, ratio of fields for complete electron collection, rise time of ionization pulses, and alpha and fission saturation curves, were observed as a function of the chamber gases. (auth)

2822 RDB(R)/TN-36

Research and Development Branch, Industrial Group (Headquarters), United Kingdom Atomic Energy Authority, Risley, Lancs (England)

THE THERMAL PROPERTIES OF CARBON DIOXIDE, NITROGEN, AIR, HYDROGEN, AND HELIUM. A. W. Nicklin. Dec. 30, 1954. 21p.

This note presents a standard set of values of the thermal conductivities, viscosities, and specific heats of carbon dioxide, nitrogen, air, hydrogen, and helium over the temperature range 0° to 600°C for ease in heat-transfer calculations and experiments. A literature search has revealed experimental data for the properties of these gases and has allowed a comparison to be made in many cases between the results of different experimenters. Wherever possible, the selected values are supported by the work of two different authors. A brief survey of the available data is given and the various experimental methods are discussed. The values are displayed as graphs at the end of the note. 20 references. (auth)

2823

THE IMPORTANCE OF COMPLEX GASEOUS MOLECULES IN HIGH TEMPERATURE SYSTEMS. Leo Brewer and James S. Kane (Univ. of California, Berkeley). J. Phys. Chem. 59, 105-9(1955) Feb.

The influence of polymerized gaseous molecules upon equilibrium pressure measurements and upon measurements of rate of vaporization is discussed. Vaporization data for red phosphorus and arsenic are presented, and the existence of catalytic effects upon rates of vaporization is demonstrated. (auth)

2824

COMPRESSIBILITIES OF SOME SOLIDIFIED GASES AT LOW TEMPERATURE. John W. Stewart (Harvard Univ., Cambridge, Mass.). Phys. Rev. 97, 578-82(1955) Feb. 1.

The compressibilities of several solidified gases have been measured by applying a one-sided compression directly to a cylindrical sample, and observing the resulting volume change. Pressure was conveyed to the samples at low temperature by means of long stainless steel compression and tension members. Preliminary extrusion experiments with these solidified gases assured that the pressure

applied to the samples was always at least approximately hydrostatic. Compressibility data have been obtained at pressures up to 10,000 kg/cm^2 for solid hydrogen and deuterium at 4°K, and to 4000 kg/cm^2 for solid neon at 4°, solid argon at 65° and 77°, and solid krypton at 77°. A single less accurate determination has also been made for solid nitrogen up to 3000 kg/cm^2. (auth)

INSTRUMENTS

2825 AD-22410

Radiation Research Corp.

DOSIMETER CHARGER (RADIOACTIVE). QUARTERLY REPORT [FOR] APRIL 2, 1953 TO JUNE 30, 1953. M. J. Cohen. July 2, 1953. 26p. Contract NObsr-63046.

Research was directed toward the development of a small, long-life voltage source, having no moving parts for potential generation, and capable of charging the IM-9( ) PD, IM-50( )/PD, and IM-61( )/PD series dosimeters. The type D experimental dosimeter charger was selected as the basis for design of 10 developmental models. The layout of this model (Navy Department nomenclature D-1x) was completed. Assembly of the 10 units is 40% completed. A preliminary study of the power requirements for neutron counters is included. (ASTIA Abst.)

2826 AMRL-168

Army Medical Research Lab., Fort Knox

PRELIMINARY REPORT ON A COMPLETE PORTABLE FIELD X-RAY UNIT. A[rthur] W. Carpenter, R. R. Heer, Jr., L. H. Krohn, E. W. Coleman, and F. J. Boyer. Nov. 26, 1954. 23p.

By combining an isotopic Tm^{170} radiation source with α self-processing cassette, a light-weight portable unit was developed. Diagnostic radiography done in the field by means of this isotopic unit, including radiation source and nondark-room cassette, prove feasible and satisfactory. Mobility and independence of such units from specialized equipment surpass by far that available with conventional x-ray units. (auth)

2827 KAPL-1276

Knolls Atomic Power Lab.

METHOD OF MEASURING HI-MEG RESISTORS. E. J. Wade. Jan. 7, 1955. 19p. Contract W-31-109-Eng-52.

A method of measuring high resistances is described which is semiautomatic and depends on a capacitor as a standard. This avoids the necessity of using high resistance standards and results in more accurate measurements. (auth)

2828 NP-3822

Technical Information Bureau, Ministry of Supply (England)

BIBLIOGRAPHY OF INFORMATION ON SERVOMECHANISMS AND RELATED SUBJECTS. Nov. 1950. 144p. (ATI-110138)

2829 NP-3822(Add.1)

Technical Information Bureau, Ministry of Supply (England)

BIBLIOGRAPHY OF INFORMATION ON SERVOMECHANISMS AND RELATED SUBJECTS. ADDENDUM NO. 1. Nov. 1953. 123p. (AD-34485)

2830 NP-5534

Massachusetts Inst. of Tech.

INTERNAL STRESS GAUGES FOR CEMENTITIOUS MATERIALS. Y. C. Loh. July 1951. 140p. Contract N5ori-07847.

A discussion is presented of (1) the design requirements of internal gages, (2) the different electric, acoustic and optical gaging systems which are applicable to internal measurements, and (3) the construction and test results of an internal stress gage. The basic principles of different types of gaging systems such as electrical resistance, electrical capacitance, electrical inductance, magnetostriction, piezoelectric, acoustic, optical, etc., which are applicable to internal measurements, are described. The design of an internal stress gage for use in concrete is given in detail. The gage is $\frac{1}{2}$ in. diameter and $1\frac{1}{4}$ in. long and made of chrome-molybdenum steel. The equivalent modulus of elasticity of the gage is 5×10^6 lbs/in^2. and the working range is from 1000 lbs/sq in. in tension to 9000 lb/in^2. in compression. The accuracy of the gage is about ± 50 lbs/in^2. The gage is designed to be used for both static and dynamic measurements. Bonded electric resistance wire is used as the gaging system of the stress gage. The wire consists of two windings which are perpendicular to each other. One winding is the active arm; the other is the compensating arm. The method of winding the wire is also described. The results of tests of embedded stress gages under compressive load, tensile load, lateral load, sustained load and dynamic load are presented. (auth)

2831 ORNL-1807

Oak Ridge National Lab.

A SINGLE-CRYSTAL ADAPTER FOR THE NORELCO WIDE-RANGE DIFFRACTOMETER. R. J. Fox, F. A. Sherrill, and M. C. Wittels. Jan. 19, 1955. 17p. Contract W-7405-eng-26.

A single-crystal adapter is described which extends the use of the Norelco wide-range diffractometer to the study of single crystals larger than those which can be examined by precession and Weissenberg methods. Applications of the instrument in studies of effects of irradiation on single crystals of Si, Cu, In antimonide, and quartz are reported briefly. (C.H.)

2832

FIRE PREVENTION BY NUCLEAR DETECTION. Atomics 6, 40, 53(1955) Feb.

A sensitive nuclear fire detector is described which contains strips of α-emitting radioactive material. The interception of α particles by the smallest trace of smoke is sufficient to trigger off a special relay tube. The source is everlasting and the relay tube consumes no current while the detector is on guard. (L.M.T.)

2833

ELECTRONIC CONTROL OF RESISTANCE WELDING. C. R. Bates (Bates and Bates, Ltd., Birmingham, England). J. Brit. Inst. Radio Engrs. 15, 31-46(1955) Jan.

After a description of the requirements of resistance welding processes, some typical electronic welding-controls are described. Basic circuits of timing and sequence controls are given, together with the principles of operation of complete control units. The latest form of "all electronic" sequence timers is described. The need for synchronous control is explained, and after describing the various subcircuits of such controls, a typical complete circuit of a spot-welder synchronous control is given. Slope control of weld current is mentioned briefly. (auth)

2834

AN AUTOMATIC PRESSURE RECORDER FOR THE STUDY OF GAS PHASE KINETICS. D. Patterson and R. C. Seymour

(Univ. of Bristol, England). J. Sci. Instr. 32, 50-1(1955) Feb.

An automatic pressure recorder suitable for kinetic studies in gas phase reactions in a constant volume system has been described. The instrument has been used up to pressures of 100 cm of mercury and follows rise or decrease in pressure to 0.5 mm of mercury. A self-balancing servomechanism applies an external pressure equal to the pressure in the reaction system, and the magnitude of this pressure is continuously recorded on a pen-chart as a function of time. (auth)

2835

ADAPTATION OF A STANDARD X-RAY POWDER CAMERA FOR WORK AT LOW TEMPERATURES. J. Thewlis and A. R. Davey (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 32, 79(1955) Feb.

2836

THE DESIGN AND USE OF INSTRUMENTS AND ACCURATE MECHANISM. Thomas North Whitehead. New York, Dover Publications, Inc., 1954. 283p.

This book is a practical discussion of instrument planning and design considerations, applicable to precision devices as well as to the general class of measuring and control instruments. Part I consists of an essentially non-mathematical discussion of instrument errors which is applied to a variety of typical mechanisms in Part II. (K.S.)

ISOTOPE SEPARATION

2837 AECD-3641

Oak Ridge National Lab., Y-12 Area

THE ELECTROMAGNETIC CONCENTRATION OF THE ISOTOPES OF HAFNIUM. L. O. Love and W. A. Bell. Feb. 5, 1951. Decl. with deletions Nov. 18, 1954. 24p. Contract W-7405-eng-26.

The six known stable isotopes of hafnium have been concentrated for the first time by the electromagnetic process, and enriched samples of these isotopes are now available. Samples were also collected in the 170, 172, and 182 mass position in order that the presence of unknown isotopes in these positions might be investigated. (auth)

2838 K-1190

Carbide and Carbon Chemicals Co. (K-25)

THE THEORY OF ISOTOPE SEPARATION BY COUNTERCURRENT CHEMICAL EXCHANGE. W. C. DeMarcus and E. Von Halle. Jan. 19, 1955. 63p. Contract W-7405-eng-26.

The theory of isotope separation by countercurrent chemical exchange is worked out in detail using the continuous transfer concept. A comparison is made with discrete stagewise processes such as gaseous diffusion and with various general concepts of solvent extraction. The effects of a cell structure in the flow system is also worked out. An elementary design procedure is included both for the no-loss case and the case where the losses are small. In addition, a method of estimating stage lengths or transfer rate constants from small scale batch experiments is presented. (auth)

2839 Y-813

Oak Ridge National Lab., Y-12 Area

THE ELECTROMAGNETIC CONCENTRATION OF CARBON-12. L. O. Love and W. A. Bell. Sept. 27, 1951. Decl. Nov. 18, 1954. 21p. Contract W-7405-eng-26.

Collection of a 1-g C sample enriched in C^{12} concentration to 99.96% has been accomplished. This material was obtained by combining the best 11 of 48 samples produced and represents approximately $\frac{1}{20}$ of the total material collected. Operations, techniques used, sample weights, and assays are reported. (auth)

MASS SPECTROGRAPHY

2840 BNL-1950

Brookhaven National Lab.

THE MASS SPECTRUM OF LITHIUM IODIDE. Lewis Friedman. [1953?]. 24p.

The mass spectrum of lithium iodide vapor produced from salt heated in an oven in the ion source of an analytical mass spectrometer was investigated as a function of oven temperature. Evidence was obtained for the existence in the vapor of both monomer and dimer. Partial heats of sublimation to monomer and dimer at O°K were found to be 44.5 ± 7 and 45.0 ± 2 kcal, respectively. The heat of dissociation of $(LiI)_2$ into gaseous monomers was found to be 44.0 ± 2.2 kcal. The partial heat of sublimation of monomer was used with supplementary thermochemical data to obtain values for the lattice energy and the heat of dissociation of the diatomic molecule. Appearance potentials for the major ions in the spectrum were determined. Upper limits for the energy of dissociation of the gaseous diatomic molecule were derived from the appearance potentials of Li^+ and I^+ which were slightly higher than the thermochemical value. (auth)

2841

MASS SPECTROMETER ANALYSES USING A VISCOUS LEAK. H. C. Mattraw, R. E. Patterson, and C. F. Pachucki (Knolls Atomic Power Lab., Schenectady, N. Y.). Appl. Spectroscopy 8, 117-20(1954) Aug.

Suitable dimensions of capillaries have been given which will provide continuous sampling of gas streams at 100 to 1000 mm(Hg). Methods of calibration of these capillaries (viscous leaks) for mass spectrometer analyses are presented. (auth)

2842

A MASS SPECTROMETRIC STUDY OF GASEOUS SPECIES IN THE $Al-Al_2O_3$ SYSTEM. Richard F. Porter, Paul Schissel, and Mark G. Inghram (Univ. of Chicago and Argonne National, Lemont, Ill.). J. Chem. Phys. 23, 339-4[illegible] (1955) Feb.

The vaporizing species in the $Al-Al_2O_3$ system are identified mass spectrometrically. Intense ion currents of Al_2O^+ formed from gaseous Al_2O are observed. At T = 1750°K ions formed from other gaseous oxides are at least 1000 times less intense than Al_2O^+. The appearance potential of Al_2O^+ is 7.7 ± 0.2 ev. A thermodynamic treatment of gaseous Al_2O gives for $Al_2O(g) = 2Al(g) + O(g)$, $\Delta H_{298} = 256 \pm 7$ kcal. (auth)

2843

UTILIZATION OF A HETEROGENEOUS MAGNETIC FIELD IN INCREASING THE RESOLVING POWER OF A MASS SPECTROMETER. N. E. Alekseevskii, G. P. Prudkovskii, G. I. Kosourov, and S. I. Filimonov (Inst. of Physical Problems). Doklady Akad. Nauk S.S.S.R. 100, 229-32(1955) Jan. 11. (In Russian)

MATHEMATICS

2844 MLM-956
Mound Lab.
STATISTICAL SHORTCUTS. (INFORMATION REPORT). E. A. Waldfogle. Mar. 31, 1954. 40p. Contract AT-33-1-GEN-53.

Rapid and inexpensive methods for analysis of data are important when results are required immediately or when collection of large quantities of data in inexpensive compared to the cost of analysis. Frequently reference is required to large amounts of data which have accumulated for several years and it may be more economical to process more of the data by inefficient methods than to subject a smaller quantity to a rigorous statistical analysis. Rank methods for significance tests are presented which are rapid and simple in operation and which permit an experimenter to determine if differences in data are due to experimental error or to factors under investigation. Methods and tables are presented whereby estimates of the standard deviation, confidence limits, and extreme deviate may be quickly determined. Examples of the use of these parameters are shown. (auth)

2845 ORNL-1842
Oak Ridge National Lab.
MATHEMATICS PANEL SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1954. W[ard] C. Sangren, ed. Mar. 2, 1955. 56p. Contract W-7405-eng-26.

With working codes available for elementary mathematical functions and for the most-needed higher functions, a greater amount of effort was devoted during the period to problems of optimal coding and of approaching as closely to automatic coding for the Oracle as present conditions will allow. Characteristics of available subroutines were evaluated. Problems solved during the period in the fields of nuclear physics, reactor engineering, and biology are discussed. (For preceding period see ORNL-1751.) (C.H.)

2846
THE RANK CORRELATION METHOD. John T. Litchfield, Jr., and Frank Wilcoxon (Stamford Research Labs., Conn. and American Cynamid Co., Pearl River, N. Y.). Anal. Chem. 27, 299-300(1955) Feb.

The usefulness of the rank correlation method has been increased by providing a table of critical totals for two levels of probability and a nomograph which gives the rank correlation coefficient directly. Use of the method is illustrated. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

2847 AD-6374
Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION. FINAL REPORT [FOR] JULY 1, 1952—FEBRUARY 28, 1953. Irving A. Berstein, Walter G. Rothschild, Florence F. Spalding, and Earle C. Farmer. 20p. Contract DA-18-108-CML-2562.

The following systems were exposed to radiation and evaluated for possible use in dosimeters: (1) vinyl chloride-vinylidene chloride co-polymer, methyl methacrylate containing pH indicators, (2) acrylonitrile monomer systems, and (3) CCl_4—benzene—indicator—sensitizer solution. (L.M.T.)

2848 AD-6512
Tracerlab, Inc.
CHEMICAL SYSTEMS SENSITIVE TO RADIATION. MONTHLY REPORT NO. 20 [FOR] FEBRUARY 1, 1953—FEBRUARY 28, 1953. Irving A. Berstein, Walter G. Rothschild, Florence F. Spalding, and Earle C. Farmer. Feb. 28, 1953. 14p. Contract DA-18-108-CML-2562.

Fifty colorimetric dosimeters utilizing the CCl_4—benzene—indicator—sensitizer system and nine acrylonitrile dosimeters were submitted for field tests. Methods of preparation are discussed, and sketches of the dosimeters are included. No performance data are given. (L.M.T.)

2849 AD-12123
New York Univ. Coll. of Engineering
GEIGER COUNTERS. [A REVIEW OF TIME-LAG MEASUREMENTS IN GEIGER COUNTERS]. REPORT NO. 141.04. [Joseph Agresta. 1953?]. 32p. Contract N6-onr-onr-279, T. O. 12.

The 3 causes of delays in Geiger counters are discussed. They include the electron transit time formed in the initial ionizing event from its place of origin to the avalanche region, the time for the discharge to spread along the length of the wire, and the time requied for the positive ion sheath to drift far enough from the central wire to permit formation of a large enough pulse for detection. Various experimenters are cited with detailed comparisons of their experimental procedures and results. A discussion of the long transit lags due to negative ions is included. (auth)

2850 NML-5115-B-19.15(Pt.3)
Naval Material Lab., New York Naval Shipyard
INVESTIGATION OF PULSES FROM GEIGER-MUELLER TUBES OPERATED UNDER VARIOUS CONDITIONS OF CAPACITANCE AND RESISTANCE LOADING. FINAL REPORT. W. G. Egan and G. E. Davis. Apr. 17, 1953. 41p. (AD-25023)

An NRL-type plateau tracer was investigated for its suitability in obtaining GM-tube plateau characteristics. Each tube was operated at various applied voltages, and subjected to x-ray pulses at the rate of 200/sec. The intensity of the x rays during each pulse and the pulse duration were adjusted so that the tube triggered only once for each x-ray pulse. An investigation was made of the effects on the tube pulses of: (1) an anode resistor; (2) a shunt capacity; and (3) a parallel circuit containing resistance and capacity in series. The pulse shape, statistical measurements, rise times, and dead times for each condition were observed for each tube. The values of capacity and resistance found in the NRL rate meter tended to increase the spurious peak production of the tube under test. An opposite effect (to a lesser degree) resulted from the low shunt capacity of 40 $\mu\mu$f. (auth)

2851 NP-4149(2nd Ed., Rev.)
Centre de Physique Nucléaire de l'Universite Libre de Bruxelles
DISTORSION DES EMULSIONS NUCLEAIRES. (Distortion of Nuclear Emulsions). ([NOTE] NO. 15). M. G. E. Cosyns and G. Vanderhaeghe. Apr. 1951. 7p.

Fundamental considerations are given to the problem of distortion in nuclear emulsions which occur as a result of developing, washing, fixing, and drying conditions. An attempt is made to calculate a distortion coefficient which provides for the determination of corrections to be applied to apparent curvature measurements. (K.S.)

2852 NP-5544
Centre de Physique Nucléaire de l'Université Libre de Bruxelles
DISCRIMINATION DE PARTICULES CHARGEES DANS LES PLAQUES PHOTOGRAPHIQUES NUCLEAIRES. (Discrimination of Charged Particles in Nuclear Photographic Plates). (NOTE NO. 5). M. Mortier and L. Vermaesen. Dec. 1948. (Reprint, Oct. 1951). 10p.

Special attention is given to techniques for the differentiation of short particle tracks in one type of nuclear emulsion (Ilford C2). The discrimination of α-p and α-t tracks is made by varying the conditions of plate development, particularly the pH of the developer. (K.S.)

2853 NP-5546
Centre de Physique Nucléaire de l'Université Libre de Bruxelles
MICROSCOPES POUR LA MESURE DU SCATTERING. (Microscopes for the Measurement of Scattering). ([NOTE] NO. 30). M. G. E. Cosyns. Aug. 10, 1951. 13p.

Improvements in the development of nuclear emulsions and the reduction of their distortion have progressed to the point where the limiting factor in scattering and curvature measurements is the precision of the measuring instruments. Two microscopes are described for scanning emulsions which increase the precision of angular and planar measurements. (K.S.)

2854 NYO-3863
Johns Hopkins Univ.
SPECTROMETRY OF FAST NEUTRONS. C. D. Swartz. Sept. 1954. 57p. Contracts AT(30-1)-1251 and AT(30-1)-1452.

A general discussion of neutron spectrometers for use in the energy range 0.5 to 20 Mev is presented. Several types are considered in some detail, with reference especially to their efficiency, energy resolution, and background effects; several other types are mentioned rather briefly. The application of neutron spectrometers to various problems is discussed briefly. In an appendix the application of neutron spectrometers to inelastic neutron scattering measurements is discussed in more detail, including the numerical calculation of the counting rate and energy resolution which might be expected from several neutron spectrometers applied to the same hypothetical experiment. (auth)

2855 NYO-4616
New York Operations Office, AEC
A DEVICE FOR THE MEASUREMENT OF INTEGRATED RADON SAMPLES IN THE FIELD. H. J. DiGiovanni, W. B. Harris, and H. D. LeVine. Sept. 1951. 11p.

A portable apparatus is described for the direct measurement of radon activity in the field. The sampling chamber is evacuated and carried to the sampling site, where a calibrated capillary is broken, allowing the air sample to enter the chamber. After a 4-hr period, the chamber is sealed and the activity is measured with a vibrating reed electrometer. (K.S.)

2856
ON THE CONSTRUCTION OF A GEIGER-MUELLER COUNTER FOR LIQUIDS. M. F. Van Hecke. Ann. soc. sci. Bruxelles 60, 224-7(1946). (In French)

A counter design was developed for measuring the radioactivity of liquids, particularly weak β emitters. (K.S.)

2857
THE EFFECT OF ORIENTATION ON THE ACTIVITIES OF NEUTRON DETECTORS. María de Aránzazu Vigón. Anales real soc. espan. fis. y quim. (Madrid) Ser. A 215-21 (1954) Nov.-Dec. (In Spanish)

Formulas relating activity and position of a neutron-irradiated In foil have been verified experimentally. Measurements with both thin and thick foils for epithermal neutrons and with thick foils for thermal neutrons have been carried out. The experimental results agree qualitatively with the theoretical predictions. (auth)

2858
STUDY OF THE "PRINT-OUT EFFECT" PRODUCED ON NUCLEAR PHOTOGRAPHIC EMULSIONS BY THE ALPHA PARTICLES OF POLONIUM. L. Winand. Bull. soc. roy. Liege, No. 1, 18-24(1950) Jan. (In French)

Geometrical relationships are established for calculating the number of α particles crossing a nuclear emulsion from a Po source. Comparison of standard data with other experiments shows that an improved contrast is obtained by the use of diluted developer, and that plates treated in such a way are particularly suited to scanning by a microscope. (K.S.)

2859
ON THE DIFFUSION OF SODIUM URANYLCARBONATE IN NUCLEAR PHOTOGRAPHIC PLATES. Roger Desprez and Max Morand. Compt. rend. 240, 417-19(1955) Jan. 24. (In French)

An experimental method is described for observing the diffusion effects in the sensitive volume of a nuclear plate by bringing one surface into contact with a UO_2CO_3 solution and identifying the α tracks produced. (K.S.)

2860
LUMINESCENCE CHAMBER. E. K. Zovoiskii, G. E. Smolkin, A. G. Plakhov, and M. M. Butslov. Doklady Akad. Nauk S.S.S.R. 100, 241-3(1955) Jan. 11. (In Russian)

A phosphor, CsI(Tl) in the case described, is used in conjunction with a photocathode to register events occurring in 10^{-12} to 10^{-14} sec. Photographs taken with the apparatus of a $\pi-\mu$ decay and several stars are shown. (G.Y.)

2861
THE SCINTILLATION COUNTER IN INDUSTRY WITH REFERENCE TO STABILITY PROBLEMS. J. S. Eppstein (Isotope Developments Ltd., Beenham Grange, Berks, England). J. Brit. Inst. Radio Engrs. 15, 25-9(1955) Jan.

The characteristics of scintillation counters for detection of high and low energy gamma rays are discussed. Stability problems are shown to be caused by changes in photomultiplier gain, and a circuit is given for minimizing the effects of these and so making the counter suitable for industrial use. (auth)

2862
COILS FOR MAGNETIC FIELD PRODUCTION IN WILSON CHAMBERS. G. Wind and M. Scherrer. J. phys. radium 16, 92-6(1955) Feb. (In French)

Parametric studies were made on the design of nonferrous coils for the production of uniform magnetic fields. A family of curves was calculated which relate power consumption, weight of conductor material (Al or Cu), current density, and magnetic field intensity. An analysis of the axial component variation in the median plane leads to a cross section which yields a field uniformity of 1 part in

100 for a volume 60 × 40 × 12 cm. A field of 1953 gauss was obtained from a power consumption of 53 kw. (K.S.)

2863

CHARACTERISTIC CHANGES OF THERMIONIC ORIGIN GEIGER COUNTERS. R. Meunier, M. Bonpas, and J. P. Legrand. J. phys. radium 16, 145-8(1955) Feb. (In French)

The characteristic change of Geiger counters, excluding penetrating cosmic radiation and the natural radioactivity of the counter materials, is composed of a part which depends on the temperature. The effect is governed by Richardson's law relative to a discharge potential of 0.65 v. It is concluded that an emission of positive alkaline ions by the cathode is responsible for the effect. (K.S.)

2864

GEIGER COUNTERS WITH INTERNAL ELECTRODES CONTAINING TRITIATED WATER VAPOR. R. Meunier, M. Bonpas, and J. P. Legrand. J. phys. radium 16, 148-51 (1955) Feb. (In French)

A sensitive and simple procedure is outlined for determining T by the introduction of tritiated water vapor within the sensitive volume of a Geiger counter. A T concentration of 10^{-14} was detected in a counter volume of 20 cm^3. (K.S.)

2865

DETECTOR SYSTEM OF CIRCULAR SYMMETRY FOR INTERNAL AUTOMATIC CONTROL OF A WILSON CLOUD CHAMBER. H. de Laboulaye and P. Barreau. J. phys. radium 16, 151-4(1955) Feb. (In French)

A cloud chamber control technique is described which uses a circular wire concentric with a radioactive source within the sensitive volume. The results indicate the feasibility of applying this method to the study of angular distributions. (K.S.)

2866

THEORETICAL STUDY OF THE OPERATION OF THE LAST STAGE OF A PHOTOMULTIPLIER. P. Leuba. J. phys. radium 16, 161-2(1955) Feb. (In French)

2867

OF THE USE OF ABSORBING SCREENS IN THE SENSITIVE LAYER OF A DIFFUSION CHAMBER. Anatole Rogozinski. J. phys. radium 16, 166-7(1955) Feb. (In French)

The introduction of metallic absorbers in diffusion and cloud chambers frequently gives rise to undesirable thermal distributions which produce turbulence and consequent obscuration of the tracks. It is suggested that this condition can be alleviated by cutting the absorbers in several sections to provide thermal isolation of each piece. Good results are reported from a setup using this technique, where the Pb absorber pieces are joined by plexiglass. (K.S.)

2868

AN INSTRUMENT FOR THE FORMATION OF VISUAL IMAGES OF IONIZING RADIATIONS. W. V. Mayneord, H. D. Evans, and S. P. Newbery (Royal Cancer Hospital, London, England). J. Sci. Instr. 32, 45-50(1955) Feb.

The apparatus described presents visual images of distributed radioactive sources. By means of image storage facilities, it is possible to build up the picture, line by line, over a long period of time and then to "read" the complete image at any convenient time thereafter. Problems of resolution and limits of detection are discussed and illustrated by photographs. (auth)

2869

THE STABILITY OF THE CALIBRATION OF LIQUID SAMPLE GEIGER-MÜLLER COUNTER TUBES. N. Veall and A. E. Lowe (Hammersmith Hospital, London, England), and R. E. Whyard (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 32, 65-6(1955) Feb.

It is possible to construct equipment for the automatic counting of radioactive samples in solution by placing each sample in a different counter tube of the liquid sample type (CV2145) and switching to each tube in turn. The day-to-day variation of the calibration factor of such tubes, which is the main source of error in the method, is found to be ± 0.6%. Background errors due to γ radiation from samples in adjacent tubes are reduced to less than 0.1% by suitable lead shielding. The results are also relevant to the use of liquid sample counters as calibrated secondary standards for the absolute assay of radioactive isotopes. (auth)

2870

SCINTILLATION COUNTING FOR MULTIPLE-TRACER STUDIES. G. J. Hine, B. A. Burrows, L. Apt, M. Pollycove, J. F. Ross, and L. A. Sarkes (V. A. Hospital, Boston, Mass.). Nucleonics 13, No. 2, 23-5(1955) Feb.

Well counters provide a simple method for measuring two or more radioisotopes in a liquid sample. In a NaI(Tl) counter, Cr^{51} and Fe^{59} γ rays are separated by pulse-height discrimination. $K^{42}-Na^{24}$ samples require NaI(Tl) and plastic scintillator wells; the latter counts K^{42} β rays but has low γ-ray sensitivity. (auth)

2871

PROPORTIONAL FLOW COUNTER WITH HIGH-HUMIDITY GAS. Gosta Nilsson and Gunnar Aniansson (Royal Inst. of Tech., Stockholm, Sweden). Nucleonics 13, No. 2, 38-9 (1955) Feb.

Spurious counts due to humid flow gas can be eliminated with proper choice of gas and descriminator level. Gases of lower ionization potential than water, e.g., ethane, provide useful plateaus at 79% relative humidity. (auth)

2872

VERY WIDE-RANGE ABSORPTION COUNTING SYSTEM. W. H. Baker, M. L. Curtis, L. B. Gnagey, J. W. Heyd, and J. S. Stanton (Mound Lab., Miamisburg, Ohio). Nucleonics 13, No. 2, 40-3(1955) Feb.

A windowless proportional counter and wide-range amplifier are used with absorbers ranging in thickness from below 10 $\mu g/cm^2$ to above 75 mg/cm^2. The combination permits identification of particles from 10-kev betas to 5-Mev alphas. Techniques for constructing very thin absorbers are given. (auth)

2873

SCINTILLATION COUNTER FOR VAPOR-PHASE ANALYSIS. K. L. Mai and A. L. Babb (Univ. of Washington, Seattle). Nucleonics 13, No. 2, 52-4(1955) Feb.

The application of a scintillation counting technique to the continuous analysis of a vapor phase containing Co_2, H_2S, and water is reported. In this method the H_2S is tagged with S^{35} in the vapor, and P_{H_2O} and hence the composition of the vapor can be obtained from a measurement of the total radioactivity of the vapor. (L.T.W.)

2874

SCINTILLATION COUNTER FOR ASSAY OF RADON GAS. M. A. Van Dilla and D. H. Taysum (Univ. of Utah Coll. of Medicine, Salt Lake City). Nucleonics 13, No. 2, 68-9(1955) Feb.

A simple and convenient counter for assaying the exhaled air of Ra-injected dogs for Rn count has been developed. Two crystallizing dishes were coated on the inside with ZnS

phosphor and cemented together for form a 120 cm^3 closed chamber. This was placed on top of a photomultiplier, and gas to be assayed was admitted through a value. The efficiency for Rn detection was 2.25 counts per Rn disintegration. Background was 10 to 20 counts/hr. A group of 14 counters filled with equal amounts of Rn showed a standard deviation of 3.4% of the mean. There was negligible Rn loss in the materials of construction except when Lucite instead of glass was used for the chamber. (M.P.G.)

2875

COMMERCIAL FILM-BADGE SERVICES. Nucleonics 13, No. 2, 86-8(1955) Feb.

A survey was made of all known commercial suppliers of film-badge services. Data are presented in tabular form and include the names and addresses of the firms, cost of service, how often badges are supplied, method of distinguishing different radiations, calibration source, accuracy, energy range recordable, and film dose range. Information is also provided on neutron badges and film-badge holders. (M.P.G.)

2876

ENHANCEMENT OF FLUORESCENCE IN SOLUTIONS UNDER HIGH-ENERGY IRRADIATION. Milton Furst and Hartmut Kallmann (New York Univ., N. Y.). Phys. Rev. 97, 583-7(1955) Feb. 1.

Organic solutions with poor high-energy-induced fluorescence can often be made much more efficient by introducing large concentrations of substances such as naphthalene and some related compounds. The naphthalene can be considered as an intermediate solvent; the energy originally mainly absorbed in the less effective solvent goes over to the naphthalene from which it then proceeds to the fluorescent solute. Naphthalene is considerably more effective as such an intermediate solvent than any other of the known efficient solvents, e.g., xylene. It is shown that the particular effectiveness of naphthalene stems from two causes: first, the energy transfer from the "poor" solvent to naphthalene is faster than to other substances; secondly, the excited naphthalene molecule is often quenched less than, e.g., xylene by quenching atoms present in the solution. These results are applied to the enhancement of the high-energy-induced fluorescence of solutions containing various elements even as heavy as bismuth. (auth)

2877

MEASUREMENT OF γ-TRANSITION LIFETIMES BY RECOIL METHODS. S. Devons, G. Manning, and D. St. P. Bunbury (Imperial Coll., London, England). Proc. Phys. Soc. (London) A68, 18-31(1955) Jan.

Methods of utilizing the recoil motion of excited nuclei produced in disintegrations, to obtain estimates of the half lives of excited states, are described. They involve measurement either of the distance moved by the recoiling nucleus before radiation occurs, or of the small Doppler shift in frequency produced by the recoil motion. Details are given of the application of some of the methods to the measurement of the half-lives of the levels of O^{16} at 6.13 Mev (E3 transition), 6.9 Mev (E2), and 7.1 Mev (E1), with the following results: 6.13 Mev, $5 \times 10^{-12} \lesssim \tau \lesssim 10^{-11}$ sec; 6.9 Mev, $\tau \lesssim 1.2 \times 10^{-14}$ sec; 7.1 Mev, $\tau \lesssim 8 \times 10^{-15}$ second. (auth)

2878

A LARGE IONIZATION CHAMBER FOR INTEGRAL DOSE MEASUREMENTS IN BETATRON RADIATION THERAPY. J. W. Beattie, W. J. Henderson, W. S. Moos, L. L. Haas, and R. A. Harvey (Univ. of Illinois Coll. of Medicine, Chicago). Radiology 64, 219-26(1955) Feb.

A large ionization chamber is described which was designed to measure integral radiation dose in betatron radiation therapy. Ionization measurements of the entrance and exit x ray flux through the patient are made by transmission chamber methods, and their difference, when corrected for energy lost by scattered electrons, gives the integral dose. The integral-dose chamber is described, and absorption curves illustrating the x-ray flux attenuation in a phantom man and data on scattering are presented. A comparison between measured and calculated integral dose is included. (C.H.)

2879

DOSIMETRY OF LOCALIZED BEAMS. G. Shapiro, J. Ovadia, and J. S. Laughlin (Sloan-Kettering Inst., New York). Radiology 64, 227-33(1955) Feb.

The dosimetry of any high-energy x-ray irradiation involving a small beam requires that the variation of dose with distance be determined experimentally to obtain the empirical dose correction factor. In any subsequent irradiation where the same beam size is used, the Victoreen thimble chamber can be placed at a sufficiently large target distance where equilibrium conditions prevail and the empirically evaluated distance extapolation factor is then used to obtain the dose absorbed in the experimental object. The absorbed dose in absolute units can then be obtained by calculations involving the secondary electron spectrum and stopping power as a function of electron energy in the medium and gas. (auth)

MESONS

2880

FORMATION OF HEAVY PARTICLES IN HIGH ENERGY COLLISIONS. S. Z. Belen'kii (Levedev Physics Inst., Academy of Sciences, S.S.S.R.). Dolady Akad. Nauk S.S.S.R. 99, 523-6(1954) Dec. 1. (In Russian.)

The numbers and energies of τ, ηH, Λ, and ζ, and anticleons produced relative to π mesons in stars of various high energies are calculated. (G.Y.)

2881

ASSOCIATED PRODUCTION OF A τ-MESON AND A CHARGED HYPERON. K. Gottstein (Max-Planck-Institut für Physik, Göttingen, Germany). Nuovo cimento (10) 1, 284-90(1955) Feb. (In English)

In a stack of stripped emulsions an example of associated production of positively charged τ meson and of a hyperon decaying in flight into a charged L meson was observed. The mass of the hyperon is found to be $2374 \pm \frac{29}{37}\ m_e$, assuming the decay scheme $Y^+ \rightarrow \pi^+ + n + Q$. For the τ meson one obtains from range measurements $m_\tau = 963 \pm 0.5\ m_e$, all three secondaries coming to rest in the emulsion. A possible reason is suggested why some authors might have slightly overestimated the mass of their τ mesons. (auth)

2882

SEARCH FOR ELECTROMAGNETIC INTERACTIONS BETWEEN μ MESONS AND ELECTRONS. L. S. Osborne, W. D. Rankin, P. C. Stein, A. Wattenberg, and A. Winston (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 97, 809-10(1955) Feb. 1.

An attempt was made to observe the reaction $\gamma \rightarrow \mu^+ + e^-$ to 23 Mev above threshold. It was found that the cross section for this reaction is less than 10^{-31} cm^2 per proton. The

decay $\mu^{\pm} \rightarrow e^{\pm} + \gamma$ was studied, and its lifetime is longer than 10^{-9} second. (auth)

2883

FORMATION OF MESONS BY PHOTONS AND NUCLEON ISOBARS. V. I. Ritus. Zhur. Eksptl'. i Teoret. Fiz. 27, 660-76(1954) Dec. (In Russian)

The cross section for photoproduction of π mesons is calculated by considereing excited (isobaric) states of the nucleon. This is an extension of the work reported by Tamm et al. (cf. NSA 9-329). (G.Y.)

2884

EFFECT OF (NUCLEAR) VOLUME ON POLARIZATION SHIFT OF LEVELS IN MESIC ATOMS. G. E. Pustovalov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 27, 758-61(1954) Dec. (In Russian)

MICROWAVES

2885 AD-40252

Electrical Engineering Research Lab., Engineering Experiment Station, Univ. of Ill.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON RANGE OF THE SPECTRUM. QUARTERLY PROGRESS REPORT NO. 1 FOR THE PERIOD MAY 1, 1954 TO AUGUST 1, 1954. P. D. Coleman, I. Kaufman, and M. D. Sirkis. Aug, 31, 1954. 42p. Contract AF33(616)-2449.

Design characteristics are described of two microwave cavity electron accelerators and bunchers for the 1.0 to 1.5 Mev energy range. One accelerator was placed in operation, and preliminary measurements made to evaluate the resulting high-energy beam are described. Calibration and resolution of a spectroscope and an accelerator-electrostatic spectroscope arrangement to give a synchroscope type of display are described. (C.H.)

2886 AD-48846

Electrical Engineering Research Lab., Engineering Experiment Station, Univ. of Ill.

RESEARCH AND INVESTIGATION LEADING TO METHODS OF GENERATING AND DETECTING RADIATION IN THE 100 TO 1000 MICRON RANGE OF THE SPECTRUM. QUARTERLY PROGRESS REPORT NO. 2 FOR THE PERIOD AUGUST 1, 1954 TO NOVEMBER 1, 1954. P. D. Coleman, I. Kaufman, and M. D. Sirkis. Nov. 15, 1954. 71p. Contract AF33(616)-2449.

Two electron accelerators and bunchers were tested and electron beams in the 1- to 1.5-Mev range were produced. Methods of beam evaluation studied included an indirect method based upon very accurate electron momentum spectra measurements and a direct method based on the crossed electron beam technique. Preliminary studies on techniques for exciting higher order modes in cylindrical cavities are reported. (For preceding period see AD-40252.) (C.H.)

MOLECULAR PROPERTIES

2887 TT-507

ON THE APPLICATION OF THE METHOD OF ORBITALS IN THE CALCULATION OF THE INTENSITY OF RAMAN LINES. (Su Una Applicazione Del Metodo Degli Orbitali Al Calcolo Delle Intensità Delle Righe Raman). Eolo Scrocco. Translated by D. A. Sinclair from Boll. sci. fac. chim. ind., Bologna 8, 115-18(1950). 8p.

2888

THEORETICAL EVALUATION OF ATOMIC POLARIZATIONS OF DIATOMIC MOLECULES. A. P. Altshuller. J. Chem. Phys. 23, 256-8(1955) Feb.

The atomic polarizations, P_A (theor.), of five diatomic molecules, HCl, DCl, HBr, NO, and CO, have been calculated from an equation derived from dispersion theory (Van Vleck, 1927), using recent data obtained from infrared dispersion and absorption intensity measurements. These P_A (theor.) values are compared with the P_A (exp.) values obtained from dielectric constant and optical refractive index measurements. The greater accuracy of the P_A (theor.) values is emphasized. The P_A (theor.) values have been used to recalculate the the dipole moments, μ, of the diatomic molecules considered. A qualitative relationship is discussed between the series of $d\mu/dr$ and μ values for some of the diatomic molecules. The P_A (theor.) are calculated approximately for the gaseous alkali halides. (auth)

2889

MONTE CARLO CALCULATION OF THE AVERAGE EXTENSION OF MOLECULAR CHAINS. Marshall N. Rosenbluth and Arianna W. Rosenbluth (Los Alamos Scientific Lab., N. Mex. J. Chem. Phys. 23, 356-9(1955) Feb.

The behavior of chains of very many molecules is investigated by solving a restricted random walk problem on a cubic lattice in three dimensions and a square lattice in two dimensions. In the Monte Carlo calculation a large number of chains are generated at random, subject to the restrictions of no crossing or doubling back, to give the average extension of the chain $(R^2)_{AV}$ as a function of N, the number of links in the chain. A system of weights is used in order that all possible allowed chains are counted equally. Results for the true random walk problem without weights are obtained also. (auth)

NUCLEAR PHYSICS

2890 UCRL-2805

Radiation Lab., Univ. of Calif., Berkeley

PHYSICS DIVISION QUARTERLY REPORT [FOR] AUGUST, SEPTEMBER, OCTOBER 1954. Dec. 13, 1954. 43p. Contract W-7405-eng-48.

Charged pion production from complex nuclei has been studied using a 340-Mev proton beam. Nuclear emulsion data obtained in the study have been analyzed and are summarized in a table showing the variation of the $\pi^+\pi^-$ production ratio with mass number. The spectrum of positrons produced by meson decay was analyzed with a 180° focusing spectrometer. The results are in good agreement with those obtained by the spiral-orbit spectrometer. Emulsion stacks are being exposed to secondary particles from bevatron targets and to the bevatron proton beam. K particles and π and μ mesons have been found in the stacks. A study of the polarization in proton-proton scattering for low energy protons has been made. Results show no statistically significant deviation from 0% left-right asymmetry. Work on nuclear emulsions has included investigations of the causes of range straggling and H blackening. A 300-Mev neutron beam was used to produce disintegrations of oxygen nuclei in a O filled cloud chamber. Most of the ejected particles could be identified, and their energies and momenta were computed. A liquid H bubble chamber of 4 in. diameter and 2 in. thickness has been constructed and successfully operated. The differential cross section for Au for 30-Mev protons has been meas-

ured. It has a typical diffraction-type character with 5 minima between 10° and 155° spaced at 25° intervals. Operation of the 184-in. cyclotron and the synchrotron during the report period is summarized. A report on the conversion of the 60-in. cyclotron includes a history of operation of the apparatus, the major physical changes made during the conversion, and the results obtained. (For preceding period see UCRL-2691.) (M.P.G.)

2891

ANNUAL REPORT OF THE INTERUNIVERSITY INSTITUE OF NUCLEAR SCIENCES, 1952. Interuniversity Institute of Nuclear Sciences, Brussels, 1952. 98p.

2892

NUCLEAR RADIATION PHYSICS. SECOND EDITION. Ralph Eugene Lapp and Howard L. Andrews. New York, Prentice-Hall, Inc., 1954. 532p.

The first edition of this well-known text is brought up to date by a complete revision of the material. The general level and scope of treatment remains the same. An effort was made to include new material without substantial deletion of the original. (K.S.)

2893

HANDBOOK OF NEW NUCLEAR TECHNIQUES. New York, Nucleonics. $1.00.

Thirty-two selected articles from recent issues of NUCLEONICS are grouped under the categories of nuclear engineering, instrumentation, chemistry, medical and biological effects of radiation, uses of radioisotopes, and physics and bound as a handbook of new nuclear techniques. (L.M.T.)

2894

DYNAMICS OF NUCLEAR DEFORMATION. D. R. Inglis (Argonne National Lab., Lemont, Ill.). Phys. Rev. 97, 701-6(1955) Feb. 1.

The droplet model of collective nuclear motions is ordinarily based on the assumption of classical irrotational fluid flow and has been used to obtain both the rotational properties of nuclei associated with a circulating surface wave and the vibrational properties of a surface deformation, though only the rotational results are confirmed experimentally. As a partial justification of the irrotational assumption, the energy of collective rotation of a closed-shell nucleus has been derived from nucleon wave functions in an earlier paper. The vibrational problem is here similarly treated and it is shown that, in contrast to the case of rotation, the vibrational distortion of a closed-shell nucleus is so rapid that the adiabatic treatment used is not valid. The potential energy of distortion calculated with phenomenological nuclear forces is not very different from that calculated by use of the deformed three-dimensional oscillator potential, which verifies that the latter is a fairly good approximation to a "self-consistent field" for a deformed closed-shell nucleus. (auth)

NUCLEAR PROPERTIES

2895 AD-19236

Cruft Lab., Harvard Univ.

ON THE NUCLEAR MAGNETIC RESONANCE IN METALS AND ALLOYS. TECHNICAL REPORT NO. 186. N. Bloembergen and T. J. Rowland. Aug. 20, 1953. 28p. Contract N5ori-76, T. O. 1.

The shift of the nuclear resonance and the line width has been measured in α- and β-tin, thallium, lead, and several alloys. While gray tin has no shift relative to the resonance in insulating compounds, white tin has an anisotropic shift of 0.79% along the tetragonal axis and 0.74% perpendicular to it. A theory for the anisotropy and asymmetry of the observed line is given. Thallium has an anomalously broad resonance line with a shift of 1.54%. In thallium alloys the shift varies continuously with composition in each phase and has discontinuities when phase transitions occur. A maximum shift of 2.1% has been found in a Tl—Mg alloy, while the Nα Tl structure exhibits a negative shift of -1.0%. Quadrupolar effects are important when the nuclear spin $I > \frac{1}{2}$. The intinsity of the copper resonance in pure copper can be increased by annealing and decreased by cold work. In alloys like α-brass and copper-silver the intensity decreases rapidly with increasing zinc or silver content. At 25% zinc, the copper resonance becomes unobservable. These effects are explained in terms of quadrupole interaction and can give information about the state of order or disorder on an atomic scale in the alloy. (auth)

2896

EVALUATION OF THE NUCLEAR QUADRUPOLE MOMENT OF N^{14}. Andre Bassompierre. Compt. rend. 240, 285-7 (1955) Jan. 17. (In French)

A value of $Q = +0.0071 \times 10^{-24}$ cm^2 is measured for N^{14}. (K.S.)

2897

STUDY OF THE $\alpha-\gamma$ ANGULAR CORRELATIONS IN Io(Th^{230}_{90}). III. 250 KEV LEVEL. Paul Falk-Vairant and Georges Yves Petit. Compt. rend. 240, 296-7(1955) Jan. 17. (In French)

It is shown that the 250-kev level of Ra^{226} is spin 1^-. (K.S.)

2898

QUADRUPOLE INTERACTION IN Cd^{111}. Pierre Lehmann and Jacques Miller. Compt. rend. 240, 298-9(1955) Jan. 17. (In French)

The quadrupole interaction in $Cd^{111} * SO_4$ was measured by an angular correlation method, and the results are in agreement with the theory of Abragam and Pound. (tr-auth)

2899

L ABSORPTION SPECTRA AND ENERGY LEVELS OF NEODYMIUM (60) AND SAMARIUM (62). Pierre Callon. Compt. rend. 240, 615-17(1955) Feb. 7. (In French)

2900

NUCLEAR QUADRUPOLE RESONANCES OF As^{75}. R. G. Barnes (Univ. of Delaware, Newark) and P. J. Bray (Rensselear Polytechnic Inst., Troy, N. Y.). J. Chem. Phys. 23, 407(1955) Feb.

Arsenic (As^{75}) resonances for $AsCl_3$, $AsBr_3$, AsI_3, and $As(C_6H_5)_3$ and Br^{81} resonances for $AsBr_3$ are reported. Observed frequencies and signal-to-noise ratios are listed, but coupling constants were not determined. (L.M.T.)

2901

$\alpha-\gamma$ AND α- X-RAY ANGULAR CORRELATIONS IN Io(Th^{230}_{90}). G. Valladas, J. Teillac, P. Falk-Vairant, and P. Benoist. J. phys. radium 16, 12535(1955) Feb. (In French)

A method and apparatus is described for measuring the directions of α-particle emission in an ionization chamber. Corrections for geometry and the electronic equipment are calculated, and the results are applied to a study of $\alpha-\gamma$ correlations of the 67.8- and 142-kev lines of Th^{230}. A 210-kev excited state is indicated with spin 4. The results are compared with rotational level theory. An experimental study of α-x-ray angular correlations shows an isotropic x-ray emission. (K.S.)

2902

EXCITATION OF NUCLEAR ROTATIONAL STATES IN μ-MESONIC ATOMS. Lawrence Wilets. Kgl. Danske Videnkab. Selakab. Mat.-Fys. Medd. 29, No. 3, 1-22(1954).

For nuclei with large deformations, such as are encountered for $155 < A < 185$ and $A > 225$, the interaction of a μ meson with the rotational states of a nucleus produces splitting of the 2 p atomic levels which are comparable in size with the mesonic fine structure splittings. The effect increases the number of lines observed and influences the general pattern of the spectrum even when individual lines are not resolvable. There is a large probability that the nucleus be left in an excited rotational level after the meson reaches the atomic ground state, with the subsequent emission of a nuclear γ ray. Experimental studies of these effects yield directly (for nuclei with large deformations) the quantity $Q_0 < j \,||\, f(r) \,||\, j' >$ which is a weighted integral of the quadrupole charge density of the nucleus. This gives information about the magnitude and sign of intrinsic nuclear quadrupole moments and nuclear change distributions. In particluar, it provides a method of even-even nuclei, a quantity not available previously from other experiments. (auth)

2903

NUCLEAR ELECTRIC QUADRUPOLE MOMENT OF Na^{23}. M. L. Perl, I. I. Rabi, and B. Senitzky (Columbia Univ., New York). Phys. Rev. 97, 838-9(1955) Feb. 1.

The hyperfine interaction constants of the $3^2P_{\frac{1}{2}}$ and $3^2P_{\frac{3}{2}}$ excited states of Na^{23} have been measured. The hyperfine interaction constant on the $3^2P_{\frac{1}{2}}$ state is $a_{\frac{1}{2}} = 94.4 \pm 0.5$ Mc. In the $3^2P_{\frac{3}{2}}$ state, the three hyperfine level separations are given by $(3a_{\frac{3}{2}} + b)$ for $F = 3$ to $F = 2$, $(2a_{\frac{3}{2}} - b)$ for $F = 2$ to $F = 1$, and $(a_{\frac{3}{2}} - b)$ for $F = 1$ to $F = 0$, where $a_{\frac{3}{2}}$ and b are the magnetic dipole and electric quadrupole hyperfine interaction constants for the $3^2P_{\frac{3}{2}}$ state. The weak 1-0 transition was not observed, so there are two possible values of b, each giving a different value for the nuclear electric quadrupole moment, Q. The average value of the two possible coefficients are $b = +2.58 \pm 0.18$ and -21.6 ± 0.5 Mc. The corresponding values of Q are $Q = +0.11 \times 10^{-24}$ cm^2 and -0.91×10^{-24} cm^2, without corrections of the Sternheimer type. (L.T.W.)

2904

NUCLEAR SPINS AND RATIO OF MAGNETIC MOMENTS OF EUROPIUM 151 AND 153. B. Bleaney and W. Low (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 55-6(1955) Jan.

Hyperfine structure was observed in the paramagnetic resonance spectrum of the Eu^{2+} ion, and the known spins of 5/2 for Eu^{151} and Eu^{153} were confirmed. The anomalous ratio of the nuclear magnetic moments (151/153) previously given by Schuler and Schmidt (Z. Phys. 94, 457(1935)) as 2.2 was found to be 2.23 ± 0.03. (auth)

2905

THE SLOW NEUTRON CROSS SECTION OF SCANDIUM. N. J. Pattenden (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 104-9(1955) Feb.

The neutron total cross section of scandium oxide has been measured from 0.0015 eV to 5000 ev. A resonance in scandium was observed at (3600 ± 200) ev, with $\Gamma \sim 180$ ev, and at lower energies the cross section varied in a way which could be explained by the existence of a level with parameters $E_r = -(130 \pm 30)$ ev, $\Gamma_n^0 = (0.84 \pm 0.25)$ ev and $\Gamma_a = (0.25 \pm 0.1)$ ev. (auth)

2906

THE STRUCTURE OF ATOMIC NUCLEI. Luc Gillon. Rev. questions sci. (Belg.-France) 14, 494-514(1953) Oct. 20. (In French)

NUCLEAR REACTORS

2907 ORNL-991

Oak Ridge National Lab.

THE NEW BULK SHIELDING FACILITY AT OAK RIDGE NATIONAL LABORATORY. William M. Breazeale. May 8, 1951. Decl. Nov. 29, 1954. 54p. Contract W-7405-eng-26.

Detailed descriptions of the building, reactor, pool, control and safety circuits, instrumentation, and instrument bridge are given. Corrosion of the fuel assemblies in the process water is discussed, and fuel assembly arrangements for the first two critical experiments are shown. Formulas for geometric transformations of the reactor are appended. (L.T.W.)

2908

ITALY TO BUILD POWER REACTOR. Atomics 6, 52-3 (1955) Feb.

The activities of CISE (Italian center for Studies and Experimentation and CNRN (National Committee for Nuclear Research) are briefly summarized. CNRN is now particularly concerned with the building of a natural-U, heavy-water-type reactor with a power of 1,000 to 10,000 kw. (L.M.T.)

2909

USE OF A FIXED CHAMBER FOR MEASURING A WIDE RANGE OF NUCLEAR REACTOR POWERS. J. Weill and P. Braffort. J. phys. radium 16, 155-8(1955) Feb. (In French)

A method of measuring reactor power levels is considered, using a compensated ionization chamber and a Bi filter for eliminating unwanted γ counts. Geometric configurations of the system are considered in detail. (K.S.)

2910

REACTOR CONTROL-ROD THEORIES. Raymond L. Murray and John W. Niestlie (North Carolina State Coll., Raleigh). Nucleonics 13, No. 2, 18-22(1955) Feb.

Calculation of the reactivity of a cylindrical control rod centrally located in a cylindrical reactor is considered by three methods, namely, (1) fast flux finite at $r = 0$, (2) flat fast flux at $r = a$, and (3) a general method which assumes correct fast-flux boundary conditions. The general method is extended to bare and reflected reactors, and comparisons with experiment are made. (L.T.W.)

2911

WEST GERMANY STUDIES REACTOR DESIGN, MATERIALS. Nucleonics 13, No. 2, 75(1955) Feb.

The Bonn government and West German firms are sponsoring studies of reactor design and materials technology. A reactor similar to Britain's 6-Mev BEPO is being designed. In addition to research and experimental functions, the reactor would be used for small-scale production of Pu. It is planned to use ~ 25 tons of domestically mined, refined, and manufactured natural U fuel elements, and 200 tons of graphite for the moderator and an unusually large reflector. (M.P.G.)

2912

HAZARDS OF NUCLEAR POWER PLANTS. George L. Weil. Science 121, 315-17(1955) Mar. 4.

The hazardous conditions that could result from a major accident involving a nuclear power plant are discussed assuming the most pessimistic conditions that might arise. Precautionary measures that can be taken in plant design, location, and operation are described. (M.P.G.)

NUCLEAR TRANSFORMATION

2913 NP-5547

Centre de Physique Nucléaire de l'Université Libre de Bruxelles

INVESTIGATIONS ON THE ANGULAR DISTRIBUTIONS OF PROTONS FROM THE $Al^{27}(\alpha,p)$ Si^{30}-REACTION. ([NOTE] NO. 31). R. R. Roy, Jules Quéquin, and Paul Janssens. July 1951. 18p.

The angular distributions of protons from the reaction Al^{27} $(\alpha,p)Si^{30}$ has been studied for the resonance levels corresponding to the incident energies $E\alpha$ = 4.44 and 4.0 Mev. For $E\alpha$ = 4.44 Mev the maxima from the ground state (Q = 2.25 Mev) are at about 50° in the forward and 130° in the backward direction, and from the first excited state (Q = 0.02 Mev), at $\Theta < 27°$ and $\Theta > 153°$. In the case of $E\alpha$ = 4.0 Mev, the angular distribution of protons for the ground state (Q = 2.26 Mev) is isotropic and for the first excited state (Q = -0.021 Mev) the position of the maxima are in the region of 43° in the forward and 137° in the backward direction. (auth)

2914 UCRL-2799

Radiation Lab., Univ. of Calif., Berkeley

NEGATIVE PIONS FROM NEUTRON BOMBARDMENT OF DEUTERONS (thesis). Myron William Knapp. Nov. 1954. 67p. Contract W-7405-eng-48.

In order to obtain information on the neutron-neutron interaction, a cloud chamber filled with deuterium gas was bombarded with the neutron beam of the Berkeley 184-inch synchrocyclotron. The spectrum of the neutron beam, which is produced by 340-Mev protons on a 2.5-inch lithium deuteride target, is peaked at 300 Mev and extends to 340 Mev. The three reactions $d(n,\pi^-p)d$, $d(n,\pi^-pn)p$, and $d(n,\pi^-)H_e^3$ were studied. A total of 310 events were examined; the three reactions contributed 208, 80, and 22 events respectively. Laboratory-system angular distributions and energy spectra of the mesons are presented. (auth)

2915

ON A POSSIBLE APPLICATION OF A CORRELATION FUNCTION TO INTERPRETATION OF NUCELAR TRANSFORMATIONS. V. I. Gol'danskii and M. I. Podgoretskii (Lebedev Physics Inst.). Doklady Akad. Nauk S.S.S.R. 100, 237-40(1955) Jan. 11. (In Russian)

2916

NOMOGRAM FOR ESTIMATING NUCLEAR REACTION ENERGIES. Alex E. S. Green (Florida State Univ., Tallahassee). Nucleonics 13, No. 2, 34-7(1955) Feb.

A new empirical equation for nuclear masses is proposed which matches actual nuclear masses well. This equation underlies the method for estimating Q values. (L.T.W.)

2917

EMISSION OF α PARTICLES FROM EXCITED NUCLEI BY PROTONS OF 50, 100, 150, AND 450 MEV. M. Grilli and B. Vitale (Univ. of Padova, Italy), P. E. Hodgson (Univ. Coll., London, England) and M. Ladu (Univ. of Cagliari, Italy). Nuovo cimento (10) 1, 314-23(1955) Feb. (In Italian)

The photographic emulsion technique is used to investigate the disintegration of nuclei excited by monoenergetic protons. The angular and energy distributions of the secondary particles show an excess in the forward direction, and this excess is greater for the secondary particles of high energy than for those of low energy. A correlation was found between the directions of emission of the secondary particles and that of the recoil fragments from the heavy nuclei, but no significant correlation was found between the energies and angles of emission of the secondary particles. These features of the disintegrations can be accounted for by the cascade-evaporation process, with the exception of the forward excess of α particles. Several possible explanations of this effect, including direct knock-on, emission from a part of the nucleus excited to an abnormally high temperature, and multiple pick-up, are discussed. (auth)

2918

HIGH-ENERGY GAMMA RAYS FROM THE PROTON BOMBARDMENT OF FLUORINE. G. K. Farney, H. H. Givin, B. D. Kern, and T. M. Hahn (Univ. of Kentucky, Lexington). Phys. Rev. 97, 720-5(1955) Feb. 1.

Resonances for emission of gamma rays of energy greater than 8 Mev in the reaction F^{19} (p,γ) Ne^{20} have been measured for proton energies from 550 to 1450 kev using a thin target. Resonances were seen at 669, 874, 935, 980, 1090, 1280, 1320, 1355, 1380, and 1430 kev. The effect of false high-energy gamma-ray counts resulting from the nearly simultaneous detection of two 6 to 7 Mev gamma rays in the reaction F^{19} $(p,\alpha\gamma)O^{16}$ was noted and a method for correcting for this effect was devised. The intensities of gamma rays for the two reactions were compared at each resonance. Also, the angular distribution of the 12-Mev gamma rays emitted at the 669-kev (p,γ) resonance was measured and found to be isotropic to within two percent probable error. (auth)

2919

SHORT-PERIOD DELAYED NEUTRONS FROM FISSION. P. J. Bendt and F. R. Scott (Los Alamos Scientific Lab., Phys. Rev. 97, 744-9(1955) Feb. 1.

A new group of delayed neutrons having a mean life of 216 ± 60 msec has been observed to follow fission of U^{235}. The apparent yield is 2.7 ± 0.7% of the delayed neutrons. The experiment was done using a multiplying assembly of U metal bombarded once every 30 sec by x rays from a betatron. A discussion is given of the hypothesis that these delayed neutrons follow the decay of Li^9 and that Li^9 is formed as the light fragment in ternary fission. (auth)

2920

TRITIUM PRODUCTION FROM LITHIUM BY DEUTERON BOMBARDMENT. R. L. Macklin and H. E. Banta (Oak Ridge National Lab., Tenn.). Phys. Rev. 97, 753-7(1955) Feb. 1.

The tritium production cross section has been measured for Li^6 bombarded by deuterons from 0.4 to 4.0 Mev. The cross section rises fairly rapidly to 190 millibarns near 1 Mev, then more slowly to 290 millibarns near 4 Mev. The cross section for Li^7 rises steeply from the 1.27 Mev threshold to 95 millibarns at 2.4 Mev; then more slowly to about 165 millibarns at 4.1 Mev. (auth)

2921

ATTEMPT TO DETECT THE ANTINEUTRINOS FROM A NUCLEAR REACTOR BY THE $Cl^{37}(\bar{\nu},e^-)A^{37}$ REACTION.

Raymond Davis, Jr. (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 97, 766-9(1955) Feb. 1

Tanks containing 200 and 3900 liters of carbon tetrachloride were irradiated outside of the shield of the Brookhaven reactor in an attempt to induce the reaction $Cl^{37}(\bar{\nu},e^-)A^{37}$ with fission product antineutrinos. The experiments serve to place an upper limit on the antineutrino capture cross section for the reaction of 2×10^{-42} cm^2 per atom. Cosmic-ray-induced A^{37} was observed and the production rate measured at 14,100 feet altitude and sea level. Measurements with the 3900-liter container shielded from cosmic rays with 19 feet of earth permit placing an upper limit on the neutrino flux from the sun. (auth)

2922

TRITIUM AND NEUTRON PRODUCTION BY 2.2-BEV PROTONS ON NITROGEN AND OXYGEN. E. L. Fireman and F. S. Rowland (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 97, 780-2(1955) Feb. 1

The cross sections for tritium production by 2.2-bev protons on nitrogen and oxygen are measured to be 28 ± 4 and 33 ± 4 mb, respectively. The cross sections for neutron production by 2.2-bev protons are measured to be 1000 ± 400 mb for nitrogen and 650 ± 250 mb for oxygen. These results indicate that cosmic-ray primaries produce approximately 0.05 tritons/cm^2 sec and 1-2 neutrons/cm^2 sec in the first nuclear interaction with the atmosphere. (auth)

PARTICLE ACCELERATORS

2923 CERN-PS/MM-9

[European Council for Nuclear Research]

MESURES AU MOYEN D'UN INTEGRATEUR DU CHAMP MAGNETIQUE ET DE SON GRADIENT DANS LE MODELE AC III B, ALIMENTE EN IMPULSION. (Measurements of the Magnetic Field and Its Gradient in the Pulsed Model AC III B [Magnet] by Means of an Integrator. Dec. 1954. 23p.

Magnetic field buildup and variations in the field gradient due to eddy currents are studied in a ⅓-scale test magnet for the CERN synchrotron. An electronic integrating circuit is described for obtaining the data. (K.S.)

2924 NYO-6668

Palmer Physical Lab., Princeton Univ.

AN ENERGY CONTROL FOR EXTERNAL CYCLOTRON BEAMS. G[len] Schrank. Jan. 14, 1955. 15p. Contract [AT(30-1)-937, Scope 2].

A device is described which stabilizes the mean energy of the external beam from an FM cyclotron to 0.1%. It is also used as an absolute instrument to measure the mean energy to 0.3% at the same time. (auth)

2925

THYRATRON CONTROL OF THE DIRECT CURRENT SUPPLY OF A 100-KW CYCLOTRON AMPLIFIER. L. Gillon and Y. Hecq. Ann. soc. sci. Bruxelles Ser. I 67, 318-26(1953) Dec. (In French)

RADIATION ABSORPTION AND SCATTERING

2926 CVAC-245T

Consolidated Vultee Aircraft Corp.

A MONTE CARLO EVALUATION OF SINGLE SCATTERING INTEGRALS. Earl Feinauer. Mar. 19, 1954. 23p. (MR-N-25)

This study was conducted to investigate the applicability of Monte Carlo sampling techniques to theoretical calculations of gamma and neutron scattering. The single scattering of gamma rays in air was evaluated by Monte Carlo techniques, using a table of random numbers to determine the points at which evaluations of the integrand were made. The investigation gave a value of 0.7863 mr/hr/curie for the air scattered dose for N = 126 which is within 3.24% of the 0.7616 mr/hr/curie reported in MR-A-319. A complete tabulation of the results are given. (auth)

2927 KAPL-1269

Knolls Atomic Power Lab.

SLOWING DOWN OF NEUTRONS BY HYDROGENOUS MODERATORS. H[enry] Hurwitz, Jr. and P. F. Zweifel. Feb. 10, 1955. 34p. Contract W-31-109-Eng-52.

Methods of treating the Boltzmann equation for the case of a sinusoidally distributed source of fast neutrons in a material containing hydrogen are discussed and compared. The effects of the simplifying assumptions commonly employed in reactor calculations are analyzed. A technique which is particularly suitable for accurate numerical integration of the Boltzmann equation in the above case is described. Numerical results are being obtained by this method and will be presented and compared with results obtained from other approximate methods in a subsequent paper. (auth)

2928 NP-5548

Centre de Physique Nucléaire de l'Université Libre de Bruxelles

SUR LA PREDETERMINATION DU PARCOURS DES PARTICULES CHARGEES DANS DIVERS MILLEUX COMPOSES. (On the Predetermination of Charged Particle Tracks in Various Compound Media). ([NOTE] NO. 25). P[aul] Janssens. May 1951. 13p.

A technique for determining the Li in minerals and tissues by observing the α particles and tritons produced by neutron bombardment has led to a consideration of particle range predictions in various materials. Equations are developed which provide an accurate means for predicting the range of α particles and tritons in materials. (K.S.)

2929 UCRL-2833

Radiation Lab., Univ. of Calif., Berkeley

SCATTERING AND ABSORPTION OF π^+-MESONS IN LEAD (thesis). George Saphir. Jan. 4, 1955. 45p. Contract W-7405-eng-48.

The interactions of 50 ± 15-Mev π^+ mesons in lead were investigated by means of a magnet cloud chamber containing a single ⅛-inch lead plate. The following cross sections were found: for elastic scattering greater than 40°, 252 ± 36 mb; for star production, 852 ± 82 mb; for charge-exchange scattering, 27 ± 19 mb. Only one of the 52 observed scatters was inelastic. The elastic scattering has a minimum near 90°. The mean free path of π^+ mesons in nuclear matter, derived from the inelastic events and large-angle scatters in this experiment, is $(9.0 \pm 1.5) \times 10^{-13}$ cm. The results are compared with information from related experiments. (auth)

2930 UCRL-2843

Radiation Lab., Univ. of Calif., Berkeley

PION-PROTON SCATTERING TABLES. James A. Baker and John Killeen. Jan. 24, 1955. 62p. Contract W-7405-eng-48.

Tables are given for the elastic scattering of 300- to 6,000-Mev pions by protons at rest. (L.T.W.)

2931

EMERGENCE OF SLOW NEUTRONS FROM A HYDROGENOUS MATERIAL. P. C. Capron and E. Crevecoeur. Bull. classe sci. Acad. roy. Belg. 39, 562-7(1953) June. (In French)

An experimental study of the neutron density from a thick source was made with a Ag detector. For thicknesses larger than the mean free path of neutrons in the material, the angular distribution of emergent neutrons is given by a function of the form $a\cos\theta + b\cos^2\theta - c\cos^3\theta$. (K.S.)

2932

ELASTIC SCATTERING OF 300 MEV NEUTRONS BY NEUTRONS. V. P. Dzelepov, B. M. Golovin, and V. I. Katarov (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 99, 943-6(1954) Dec. 21. (In Russian)

Experimental data on scattering of neutrons of 300 Mev average energy by D_2O, H_2O, paraffin, and carbon are presented, and evaluation of the (n,n) cross section is discussed. (G.Y.)

2933

DISSOCIATION OF NEGATIVE MOLECULAR IONS IN COLLISIONS WITH ATOMS. V. M. Dukel'skii and E. Ya. Zandberg (Leningrad Physico-Technical Inst.). Doklady Akad. Nauk S.S.S.R. 99, 947-50(1954) Dec. 21. (In Russian)

Observed ionization changes of 300 to 800 ev beams of Te_2^-, S_2^-, Sb_2^-, Bi_2^-, NaI^-, and NaI_2^- ions in rarefied He and A are discussed. (G. Y.)

2934

ELASTIC SCATTERING OF 460 MEV PROTONS BY PROTONS. M. G. Meshcheryakov, N. P. Bogachev, B. S. Neganov, and E. V. Piskarev (Inst. of Nuclear Problems). Doklady Akad. Nauk S.S.S.R. 99, 955-8(1954) Dec. 21. (In Russian)

Differential (p,p) cross sections for 460-Mev protons are plotted and discussed. (G. Y.)

2935

SCATTERING OF 460 TO 660 PROTONS BY PROTONS. Ya. M. Selektor, S. Ya. Nikitin, E. G. Bogomolov, and S. M. Zombkovskii. Doklady Akad. Nauk S.S.S.R. 99, 967-9(1954) Dec. 21. (In Russian)

The external beam of the phasotron (fazotron) at the Institute of Nuclear Problems was used to study the (p,p) scattering of 460-, 560-, and 660-Mev protons. Differential cross sections are plotted. (G. Y.)

2936

REMARK ON ANGULAR DISTRIBUTION IN THE (n,p) REACTION. M. Demeur. J. phys. radium 16, 73-4(1955) Jan. (In French)

2937

ELASTIC SCATTERING OF 22-MEV ALPHA PARTICLES. N. S. Wall, J. R. Rees, and K. W. Ford (Indiana Univ., Bloomington). Phys. Rev. 97, 726-32(1955) Feb. 1.

The elastic scattering of 22-Mev alpha particles from silver, gold, and lead has been measured as a function of angle. The differential cross section has been found to follow Rutherford's equation at forward angles but at some critical angle the cross section deviates, first increasing slightly for lead and gold and then decreasing monotonically. The silver distribution shows no increase. The lead and gold data have been fitted with a modification of Blair's sharp angular momentum cut-off theory, but there is no satisfactory agreement between theory and experiment for the silver data. Using this type of analysis one is able to find a nuclear radius that follows the $R = r_0 A^{1/3}$ law with $r_0 = 1.5 \times 10^{-13}$ cm only if one assumes a large size, $\sim 2.5 \times 10^{-13}$ cm, for the alpha particle. (auth)

2938

NATURE OF POSITRON ANNIHILATION IN LIQUIDS AND SOLIDS. W. R. Dixon and L. E. H. Trainor (Queen's Univ., Kingston, Ontario, Canada). Phys. Rev. 97, 733-6(1955) Feb. 1.

An interpretation of the experimental results on positrons stopping in liquid and solid media is presented in terms of annihilation from excited states of positronium. It is assumed on an empirical basis that the 2S states of positronium have sufficient stability in certain materials for direct annihilation. (auth)

2939

RECOIL DEUTERONS AND DISINTEGRATION PROTONS FROM THE n-d INTERACTION, AND n-p SCATTERING AT E = 14.1 MEV. John D. Seagrave (Los Alamos Scientific Lab.). Phys. Rev. 97, 757-65(1955) Feb. 1

A counter-telescope consisting of two proportional counters and a NaI scintillator in triple coincidence has been used to study the angular distribution of scattered deuterons and disintegration protons from the interaction of 14.1-Mev neutrons with deuterium. Charged reaction products were identified by simultaneous observation of particle energy and rate of energy loss. Thin radiators of deuterated and normal polyethylene were used, the latter to investigate the incident neutron spectrum and n-p scattering at 14.1 Mev. The absolute differential cross sections observed over the recoil angular range 0 to 55 degrees in the laboratory for elastic n-d and n-p scattering are in good agreement with the recent nuclear-emulsion results of Allred, Armstrong, and Rosen, and with the theoretical results of Christian and Gammel. The anisotropy of n-p scattering was found to be about six percent. Protons from disintegration of deuterium were observed over the angular range of 0 to 80 degrees in the laboratory, and the integrated cross section for the forward hemisphere is larger than has been observed previously. The energy distributions appear more nearly uniform than those estimated by Frank and Gammel, and the angular distribution more strongly peaked forward. (auth)

2940

π^--p INTERACTIONS AT 1.4 BEV. L. M. Eisberg, W. B. Fowler, R. M. Lea, W. D. Shephard, R. P. Shutt, A. M. Thorndike, and W. L. Whittemore (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 97, 797-808(1955) Feb. 1.

π^--p interactions have been observed in the hydrogen filling of diffusion cloud chambers exposed to a π^- beam of average energy 1.37 bev at the Brookhaven Cosmotron. If 9 interactions leading to heavy unstable particles are omitted, there remain 147 interactions observed with magnetic field and 323 interactions without field. The total cross section is estimated to be 34.6 ± 2.7 millibarns. The elastic scattering cross section is 10.0 ± 0.8 millibarns. The elastic scattering angles are mostly less than 60° in the center-of-mass system and are accordingly interpreted as mainly due to diffraction scattering. The observations are consistent with diffraction by a sphere with radius $(1.18 \pm 0.10) \times 10^{-13}$ cm and transparency 0.61 ± 0.10. However, the 20 percent of elastic scattering observed through angles >60° may indicate a region of very strong interaction with radius $\sim 0.5 \times 10^{-13}$ cm surrounded by a region of much weaker interaction. Of the inelastic events only the 95 observed in the magnet cloud chamber can be analyzed further. Of these 71

to 81 are considered to involve the production of one secondary pion and 14 to 24 two pions, depending on the assignment of unidentified inelastic cases. This indicates a slightly greater multiplicity than predicted by Fermi's statistical theory. Angle and momentum distributions of emitted pions are discussed in terms of possible pion-pion interactions and excited nucleon states, but conclusions on these questions are uncertain. (auth)

2941

SCATTERING OF 14.3 MEV NEUTRONS BY ^{4}He NUCLEI. D. F. Shaw (Clarendon Lab., Oxford, England). Proc. Phys. Soc. (London) A68, 43-5(1955) Jan.

The scattering was studied by means of a diffusion cloud chamber method similar to that used by Alston et al. (Proc. Phys. Soc. (London) A67, 657(1954)). Fillings of much less stopping power than those employed by Alston were used, thus enabling measurements at small angles. Results are in good agreement with the theoretical curve over the range 20 to 90°. (L.M.T.)

2942

ELECTRON SCATTERING IN PHOTOGRAPHIC EMULSIONS. A. Husain (University Coll., London, England). Proc. Phys. Soc. (London) A68, 45-9(1955) Jan.

Ilford G5 plates of dimensions 2 in. by 2 in. and emulsion thickness 200μ were exposed to electrons accelerated to high energies by the 20 Mev synchrotron at University College, London. Electrons of energies 6.6, 11.5 and 18.0 Mev, respectively, were incident on the plates at a grazing angle of approximately 5° and the plates were processed using the temperature development method. Measurements of the plates were made using a Beck binocular microscope. A 2mm (80×) oil immersion objective was used in conjunction with 15× compensating eyepieces fitted with a calibrated graticule and a protractor. Two types of scattering measurement were carried out with these plates. The angle of ejection and range of electron recoils were measured in a study of electron-electron scattering. Multiple scattering measurements were carried out on a number of the fast electron tracks. (auth)

2943

INELASTIC COLLISIONS BETWEEN HEAVY PARTICLES. IV. CONTRIBUTION OF DOUBLE TRANSITIONS TO CERTAIN CROSS SECTIONS INCLUDING THAT ASSOCIATED WITH THE IONIZATION OF HYDROGEN ATOMS IN FAST ENCOUNTERS WITH OTHER HYDROGEN ATOMS. D. R. Bates and G. W. Griffing (Queen's Univ. of Belfast, Ireland). Proc. Phys. Soc. (London) A68, 90-6(1955) Feb. (cf. NSA 8: 926, 927, 6324.)

Born's approximation is used to calculate the cross sections associated with the processes H(1s) + H(1s) → H(3s, p or d) + H(3s, p or d) and H(1s) + H(1s) → H^+ + e + H(3s, p or d; or C) where C represents the continuum. These cross sections and others calculated in papers I and II are combined to yield the cross section for excitation to the third quantum level, the cross sections for ionization, and the total cross section for all inelastic collisions. Both single and double transitions are taken in account. The ratio of the electron loss cross section to the electron capture cross section is computed. (auth)

2944

EXCITATION FUNCTIONS FOR THE SCATTERING OF PROTONS AND DEUTERONS BY Be AND Mg. G. W. Greenlees (Cavendish Lab., Cambridge, England). Proc. Phys. Soc. (London) A68, 97-103(1955) Feb.

Absolute differential cross sections are given for the elastic and inelastic scattering by Mg of protons with energies between 3.0 and 6.5 Mev and of deuterons with energies between 4.0 and 7.8 Mev. These were taken at an angle of 70° in the laboratory coordinates. Similar cross sections are given for protons scattered elastically and inelastically by beryllium at 90°. The levels giving rise to inelastic scattering have Q values of -1.37 ± 0.04 Mev and -2.43 ± 0.05 Mev for magnesium and beryllium, respectively. The marked difference of excitation function for protons and deuterons is noted and a discussion of possible mechanisms involved is given. (auth)

RADIATION EFFECTS

2945 AD-27424

Armour Research Foundation

RADIATION SENSITIVE GLASSES. FINAL REPORT [FOR] JUNE 1952 TO AUGUST 1953. R. Estin, D. Kazen, L[ouis] Marchi, H. Nakamura, and L. Reiffels. Nov. 23, 1953. 164p. Contract DA36-039-SC-15528.

The objective was to develop vitreous material which exhibits changes in optical absorption characteristics upon exposure to high energy radiation and to modify such materials to improve their sensitivity. Results of investigations are reported for tellurite, type K-48, and other Pennsylvania state (K-29, B-3, and Z-32) glasses. Considerable theoretical discussion is devoted to the "weak network" and "ordering" hypotheses. The best glasses developed will permit the visual detection of ~500 r under optimum conditions. Heat treatment techniques on high-temperature compositions may extend this range downward. (L.M.T.)

2946

IRRADIATION EFFECTS IN Cu, Ag, AND Au NEAR 10°K. H. G. Cooper, J. S. Koehler, and J. W. Marx (Univ. of Illinois, Urbana). Phys. Rev. 97, 599-607(1955) Feb. 1.

Electrical resistivity increases produced by 12-Mev deuteron irradiation were measured as a function of integrated deuteron flux in Cu, Ag, and Au. The bombardment temperature was near 10°K, and no thermal recovery of the irradiation effects was observed; however, evidence that appreciable radiation annealing occurred during the bombardment was found. The resistivity increases near 10°K were much larger than those previously obtained in these metals for equal irradiations made near liquid nitrogen temperature. The observed Z-dependence of the irradiation effects agreed closely with that predicted by Seitz's theory. Warmups made following the bombardments revealed that 40 to 50 percent of the total resistivity increase in Cu recovers near 43°K and from 13 to 24 percent of that in Ag anneals near 30°K; the rapid recovery in each case indicates that a unique process may be involved, and the associated activation energy is estimated to be 0.1 ev for both. It is suggested that volume diffusion of interstitial atoms or annihilation of very close interstital atom-vacancy pairs are two possible processes responsible for the low temperature recovery. In addition, for all three metals, a gradual annealing rate was observed in the intermediate temperature range 50°K to 220°K, and then a more rapid rate took place in the range 220 to 280°K. (auth)

2947

X-RAY MEASUREMENTS OF PILE-IRRADIATED LiF. D. T. Keating (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 97, 832-4(1955) Feb. 1.

X-ray measurements have been made on two LiF single crystals cleaved upon the (001) face and exposed to slow neutron flux in the Argonne pile. The exposures were approximately 2.1×10^{17} and 7.5×10^{17} nvt. (L.T.W.)

RADIOACTIVITY

2948 AECU-3004

Michigan Univ.

DECAY SCHEME OF Y^{92}. Wayne A. Cassatt, Jr. and W. Wayne Meinke. [1954?]. 20p. Contract [AT(11-1)-70].

The gamma radiations of Y^{92} have been investigated with a scintillation spectrometer. The Y^{92} was produced in a cyclotron by a (d,alpha) reaction on zirconium and was not contaminated with Y^{91} or Y^{93} isotopes present in fission product solutions. Gamma rays of 0.209 ± 0.01, 0.476 ± 0.02, 0.939 ± 0.13, 1.45 ± 0.10, and 1.9 ± 0.10 Mev have been observed and both β-γ and γ-γ coincidences tabulated. A possible decay scheme is proposed which is consistent with experimental data. (auth)

2949 ANL-5381

Argonne National Lab.

ON THE ONE-BODY MODEL OF ALPHA RADIOACTIVITY. IV. CALCULATED WAVE AMPLITUDES NEAR THE NUCLEUS. G. H. Winslow. Jan. 21, 1955. 42p. Contract W-31-109-eng-38.

Those recognized but unsolved problems in the theory of alpha decay are reviewed. Since the lack of solutions to these problems makes the calculation of channel radii illogical, values of a number related to the wave amplitude near the nucleus are calculated. For noneven-even nuclei this number is the principal term in $\log R|\phi_{J,l}(R)|^2$, where R is an arbitrary radium and $\phi_{J,l}(R)$ is R times the radial wave function for decay from a nuclear state of spin J to one of spin I. The orbital angular momentum effect is included for even-even nuclides, where J = 0. Various comparisons are made among these latter nuclides. Plots of that factor in the square of the irregular Coulomb function, which depends on the orbital angular momentum quantum number L, are given in an appendix for $0 \leq L \leq 8$. (For preceding report in series see ANL-5277.) (auth)

2950 HW-31961

Hanford Works

EXCITATION OF CHARACTERISTIC X-RAYS BY BETA-PARTICLES. M. B. Leboeuf and B. T. Stark. May 27, 1954. 16p. Contract W-31-109-Eng-52.

An experimental method for observing x-ray and γ radiation produced by β-particle excitation is described. The spectra excited by bombardment of foils with β particles have been measured using a γ scintillation spectrometer. The internal bremsstrahlung emitted by the β source was also measured for comparison. In the β-particle excitation of foils, characteristic x rays were found to be excited in yields of the order of 1×10^{-2} photons per incident β for $Sr^{90}-Y^{90}$ and 3×10^{-3} photons per incident beta for Pm^{147}. Higher energy bremsstrahlung is produced with efficiencies of approximately 6×10^{-2} photons per incident beta for $Sr^{90}-Y^{90}$ and 3×10^{-2} photons per incident beta for Pm^{147}. These efficiencies are high enough to give sources of adequate intensity for photometer use, however, the higher energy bremsstrahlung is present in sufficient abundance to raise the average γ energy to such an extent that these sources are no improvement over those currently used. (auth)

2951 ISC-510

Ames Lab.

DECAY CHARACTERISTICS OF SOME SHORT-LIVED NUCLIDES OF LOW ATOMIC NUMBER. Raymond Milton Kline and D. J. Zaffarano. July 1954. 48p. Contract W-7405-eng-26.

The short-lived activities in Cl^{34}, K^{38}, Ca^{39}, Li^8, He^6, and O^{15} formed by high-energy bremmstrahlung irradiation have been examined, and some improved values for the half lives of these nuclides are reported. A detailed description of the apparatus and procedure is included, together with a discussion of the weighted least mean square analysis used. (auth)

2952 MLM-943

Mound Lab.

DETERMINATION OF HALF-LIFE OF RADIUM-223 AND THORIUM-227. (INFORMATION REPORT). G. R. Hagee, M. L. Curtis, and G. R. Grove. Mar. 1, 1954. 13p. Contract AT-33-1-GEN-53.

Half-life values for Ra^{223} and Th^{227} have been determined by analyzing data obtained from alpha-counting of samples of less than one microcurie of each element in a 2π proportional counter over a period of 116 days. The samples of chemically separated material contained small amounts of other members of the actinium chain. The growth and decay equation of the principal activity and its daughters plus contaminants was derived in terms of the decay constants of Ra^{223} and Th^{227} and the amounts of each activity present. The true value of the half lives and amounts of activity present were set equal to an approximate value plus a correction term. Taylor's expansion was applied to the general equation to yield an expression which was linear in the correction terms. A least squares treatment was used to derive the correction terms most representative of the data. The half-life values obtained from these analyses were 18.169 ± 0.084 days for Th^{227} and 11.685 ± 0.056 days for Ra^{223}. (auth)

2953 AEC-tr-2080

THE ISOMERIC TRANSITIONS, In^{115}, In^{113}, AND Sr^{87}. L. A. Antonova and I. V. Estulin. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz. 18, 79-87(1954). 20p. (AEC-tr-2080)

An abstract of this paper appears in Nuclear Science Abstracts as NSA 8-4777.

2954

ON THE DISINTEGRATION OF Rh^{102}. Paul Avignon. Compt. rend. 240, 176-8(1955) Jan. 10. (In French)

A study of the decay scheme of Rh^{102} is made which shows that, contrary to previous experimental results, disintegration is brought about largely by orbital electron capture. (K.S.)

2955

THE DISINTEGRATION OF Rh^{105}_{45}. Jeanne Laberrigue-Frolow. Compt. rend. 240, 287-9(1955) Jan. 17. (In French)

2956

STUDY OF THE DISINTEGRATION SCHEME OF Ba^{133}. Michel Langevin. Compt. rend. 240, 289-91(1955) Jan. 17. (In French)

Gamma coincidence spectrometry was used to study the decay scheme of Ba^{133}. Electron capture events are largely due to L shell reactions, and it was found that the ratio of L to K capture is ≥ 9. The maximum energy is 40 kev, corresponding to an allowed transition. (K.S.)

2957

ON THE DISINTEGRATION OF Hg^{203}. Nadine Marty. Compt. rend. 240, 291-4(1955) Jan. 17. (In French)

It is found that the maximum β energy is 2.4 ± 2 kev, and that the limit of β spectrum intensity for the ground state is $< 4 \times 10^{-5}$ of the 214-kev level. Conversion coefficients for the 279-kev level are $\alpha_K = 0.205 \pm 0.01$, K/L = 3.15 ± 0.15, and L/M = 4.5 ± 1.5. The transition is therefore 30% M_1 and 70% E_2. (K.S.)

2958

THE GAMMA SPECTRUM OF Rh^{102}_{45}. Daniel Bes and Horacio Bosch. Compt. rend. 240, 294-6(1955) Jan. 17. (In French)

2959

STUDY OF THE DISINTEGRATION OF Tl^{204}_{81}. Tosiko Yuasa and Jeanne Laberrigue-Frolow. J. phys. radium 16, 39-47(1955) Jan. (In French)

A thick lens magnetic spectrometer was used to study the β disintegration of Tl^{204}, with uniform sources and a new type of counter window of 30 $\mu g/cm^2$. The form of the β spectrum was analyzed by Fermi plots and it was found that E_{max} = 765 ± 10 kev. No internal conversion radiation was found in the region of 215 to 315 kev. The ratio of K capture to β^- in the energy region of Auger electrons is 3 to 4%. (tr-auth)

2960

PRECISE MEASUREMENTS OF RADIOACTIVE HALF LIVES. Jacques Tobailem. J. phys. radium 16, 48-53 (1955) Jan. (In French)

Several radioisotopes were studied using a differential arrangement of two ionization chambers connected to an electrometer tube. A precision of 1% was attained for half lives of the order of several years, and an order of 0.1% for half lives of several days. The results were Co^{60}, 5.27 ± 0.07 yr; Rn^{222}, 3.825 ± 0.005 days; Ac^{227}, 21.6 ± 0.4 yr; Ga^{67}, 77.9 ± 0.3 h; Na^{24}, 14.90 ± 0.05 h; Cu^{64}, 12.80 ± 0.03 h; Au^{198}, 2.686 ± 0.005 days. (tr-auth)

2961

STUDY OF ELECTRON CAPTURE IN THE DISINTEGRATION OF THE NUCLIDE Na^{22}. G. Charpak. J. phys. radium 16, 62-5(1955) Jan. (In French)

A 4π Geiger counter was used to detect the emission of a very low-energy ray, independent of the β^+ radiation, which was completely absorbed in an Al foil of a few $\mu g/cm^2$. The ray is attributed to Auger electrons of 0.85 kev maximum energy which follow electron capture. Because of the small range of these electrons, particular attention is given to a simple method for preparing thin, uniform radioactive sources. It was found that the ratio of K capture to β^+ emission is 6.5 ± 0.9%. (tr-auth)

2962

MEASUREMENT OF THE HALF LIFE OF ThB(Pb^{212}). J. Tobailem and J. Robert. J. phys. radium 16, 115-18 (1955) Feb. (In French)

The half life of Pb^{212} was precisely measured with differential arrangement of 2 ionization chambers using 2 different methods: the differential ionization method, and the method of added sources. The results obtained in the 2 cases are in agreement. It is found that T = 10.643 ± 0.012 h. (tr-auth)

2963

REMARK OF THE DISINTEGRATION OF Tl^{204}_{81}. T. Yuasa and J. Laberrigue-Frolow. J. phys. radium 16, 165-6(1955) Feb. (In French)

2964

DISINTEGRATION SCHEME OF COPPER-62 AND ITS RELATION TO RECENT MASS MEASUREMENTS. J. M. Reid and I. F. Wright (Univ. of Glasgow, Scotland). Nature 175, 298 (1955) Feb. 12.

The existance of 0.56 Mev γ rays in the disintegration of Cu^{62} has been reported in several nuclear data tables. The γ-ray spectrum of Cu^{62} was examined by means of a NaI crystal mounted on a photomultiplier tube. No evidence to confirm the existence of 0.56 Mev γ rays was found. It was estimated that a peak containing 0.25% of the counts in the total capture peak could have been detected. The total release of energy in the Cu^{62} disintegration can therefore be obtained from the maximum energy of the positron spectrum and is 3.88 ± 0.1 Mev. This value throws doubt on the accuracy claimed for some recent mass measurements. (M.P.G.)

2965

THE DECAY OF ^{185}W. A. Bisi, S. Terrani, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (10) 1, 291-99(1955) Feb. (In English)

The β and γ radiation from W^{185} have been investigated by means of an intermediate image β spectrometer, a proportional counter spectrometer, and a scintillation spectrometer. The disintegration has been found to be complex. It was found that the maximum energy of the main β spectrum (90 per cent) was 426 kev and that the β transition goes to the ground state of Re^{185}. A faint γ ray of 55.6 kev was detected and found to correspond to an excited level in Re^{185}. The γ ray arises from a magnetic dipole transition. Spin and parity have been assigned and a decay scheme is proposed. (auth)

2966

DETERMINATION OF RADIOELEMENTS BY THE DISTRIBUTION OF INTERVALS BETWEEN DISINTEGRATION. EFFECTIVENESS OF ESTIMATIONS. D. Hirschberg (Univ. Libre de Bruxelles, Belgium). Nuovo cimento (10) 1, 341-3 (1955) Feb. (In French)

2967

ELECTROMAGNETIC SPECTRUM OF Am^{241}. Paul P. Day (Argonne National Lab., Lemont, Ill.). Phys. Rev. 97, 689-700(1955) Feb. 1.

The electromagnetic spectrum of Am^{241} has been studied with a ten-inch bent-crystal spectrometer and a NaI scintillation counter. Twelve γ rays, sixteen Np L x rays, and eight Am L x rays have been measured. The gamma rays in Np have energies of 26.363, 33.199, 43.463, 59.568, 103, 113, 130, 159, 210, 270, 328, and 370 kev. The x-ray energies establish the validity of the Mosley extrapolations in this region of the periodic table. Details of the spectrometer operation and calibration are given. (auth)

2968

RADIATIONS OF 34-DAY Xe^{127}. Hirdaya B. Mathur (Univ. of California, Berkeley). Phys. Rev. 97, 707-8(1955) Feb. 1.

The gamma rays of Xe^{127} have been studied in a sodium iodide scintillation spectrometer and by gamma-gamma coincidence techniques. The results support a decay scheme published previously by Bergström. (auth)

2969

INTERNAL AND EXTERNAL BREMSSTRAHLUNG IN CONNECTION WITH THE BETA DECAY OF S^{35}. N. Starfelt and N. L. Svantesson (Univ. of Lund, Sweden). Phys. Rev. 97, 708-14(1955) Feb. 1.

The internal bremsstrahlung, emitted in the β decay of

S^{35}, was investigated with a NaI scintillation spectrometer. Neither the shape of the spectral distribution nor the absolute yield was found to agree with theory. At 50 kev the experimental photon yield was 65% greater than the theoretical. At 100 kev it was even 180% greater. The total photon energy yield per β decay, 2.23×10^{-6} mc^2, was 35% greater than the calculated value. The external bremsstrahlung, emitted when the β particles from S^{35} were stopped in matter, was also investigated with the same apparatus. With elements of low atomic number the experimental values agreed with those calculated. In experiments using elements of higher atomic numbers, however, the experimental values differed widely from those calculated, the difference increasing with the atomic number. Thus, for lead at 50 kev the experimental value was 60% greater than the theoretical, and at 100 kev it was 170% greater. (auth)

2970

ENERGY LEVELS OF Rh^{103} FROM THE DECAY OF Pd^{103} AND Ru^{103}. Babulal Saraf (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 97, 715-20(1955) Feb. 1.

The decay schemes of Pd^{103} and Ru^{103} have been studied with the use of two scintillation spectrometers in coincidence. It has been observed that the electron capture activity of Pd^{103} is accompanied by faint γ radiation having the several quantum energies of 40, 65, 300, 365, and 495 kev with absolute intensities per disintegration of 1×10^{-3}, 4×10^{-5}, 1.2×10^{-4}, 6.6×10^{-4}, and 1×10^{-4}. The gamma rays of energy 65 and 300 kev were found to be in coincidence. The inner bremsstrahlung spectrum associated with the capture transition leading to the 57-minute isomeric level in Rh^{103} is of intensity small in comparison with that of the aforementioned gamma rays. The β decay of Ru^{103} is accompanied by gamma rays of energies 55, 440, 495, 555, and 610 kev with absolute intensities per disintegration of 1×10^{-2}, 5×10^{-3}, 0.90, 5×10^{-3}, and 6×10^{-2}. A β spectrum of end point 110 ± 10 kev is coincident with the 610-kev gamma ray. A level scheme for Rh^{103} with probable orbitals has been proposed. (auth)

2971

HALF-LIVES OF Mn^{52} AND Mn^{54}. E. W. Backofen and R. H. Herber (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 97, 743(1955) Feb. 1.

Manganese activities produced by deuteron bombardment of chromium powder and radiochemically purified both by standard chemical techniques and ion-exchange chromatography have been counted for a period of 2500 hr. The half life of Mn^{54} is determined to be 291 ± 1 days, while that of Mn^{52} is found to be 572 ± 0.02 days. (auth)

2972

RADIOACTIVITIES OF Zn^{69} AND Zn^{71}. J. M. LeBlanc, J. M. Cork, and S. B. Burson (Argonne National Lab., Lemont, Ill.). Phys. Rev. 97, 750-3(1955) Feb. 1.

The beta and gamma rays emitted in the decay of Zn^{69} and Zn^{71} have been studied with a ten-channel coincidence scintillation spectrometer. The previous assignments of a 435-kev isomeric transition to the 14-hr Zn^{69} activity and a 900-kev beta ray to the 1-hr Zn^{69} activity were confirmed. In addition to the 2.2-min activity of Zn^{71}, a previously unreported 3-hr activity of Zn^{71} was detected. A beta ray with an end-point energy of 2.4 ± 0.2 Mev and gamma rays with energies of 0.12, 0.51, 0.90, and 1.09 Mev were detected and assigned to the 2.2-min activity. A beta ray with an end-point energy of 1.5 ± 0.1 Mev and gamma rays with energies of 0.38, 0.49, and 0.61 Mev were detected and assigned to the 3-hr Zn^{71} activity. It was established that each of the gamma rays in the 3-hr activity is in coincidence with the other two gamma rays as well as the 1.5-Mev beta ray. Decay schemes for the two Zn^{71} activities are proposed. (auth)

2973

DECAY OF Co^{57}. L. Madansky and F. Rasetti (Johns Hopkins Univ., Baltimore, Md.). Phys. Rev. 97, 837-8(1955) Feb. 1

Gamma ray-lines of ~14 and 120 kev were found, in addition to strong x rays at 6.4 kev (K radiation of Fe). The reported line at 134 kev was not found. Extremely weak annihilation radiation ($\sim 8 \times 10^{-3}$ quanta for each quantum of 120 kev) was detected. The annihilation photons did not appear to coincide with the 120-kev line, indicating either that they belong to an impurity, or that positron decay, if any, leads mainly to the ground state of Fe^{57}. Intensity measurements showed that the numbers of x rays and 120-kev γ rays are about equal, indicating one 120-kev transition per disintegration. The intensity of the 14-kev γ ray is ~0.1 quantum per decay. The ratio of conversion electrons to 120-kev photons was found to be 0.10. The observations show that Co^{57} decays mainly by orbital electron capture; the 14- and 120-kev transitions are in cascade; the 14-kev transition procedes the other, has a lifetime at least an order of magnitude longer than a microsecond, and is not highly converted; the 120-kev transition has a short lifetime and a conversion coefficient lower than 0.1; the crossover transition is weak; and most of the disintegrations lead to the 120/kev excited state, about 10% to the 134-kev state, and none or few to the ground state. The decay scheme is shown. (L.T.W.)

2974

ALPHA-GAMMA ANGULAR CORRELATIONS AND INTERNAL CONVERSION MEASUREMENTS IN ThCC'' AND ThC'D. J. W. Weale (Imperial Coll., London, England). Proc. Phys. Soc. (London) A68, 35-42(1955) Jan.

The angular correlation between all γ rays leading to ThC' ground state and the ThC'D α rays has been measured and found isotropic, in agreement with theory. The angular correlation between the 6.04 Mev α ray and the 40 kev γ ray in ThCC'' has been measured and found anisotropic, the best fitting curve being $W(\theta) = 1-(0.22 \pm 0.05)\cos^2\theta$. Spin assignments of 1 or 2, 4 and 5 are deduced for the levels ThC (ground), ThC'' (40 kev) and ThC'' (ground) respectively. The total internal conversion coefficient of the 40 kev ThCC'' γ ray has been measured and a value for the L shell conversion coefficient of $\alpha_L = 15.7 \pm 1.6$ is deduced. This is in much better agreement with theoretical prediction than previous measurements. (auth)

2975

A NUCLEAR EMULSION STUDY OF THE RADIOACTIVE DECAY OF ACTINIUM X(^{223}Ra). B. F. Bayman and M. A. S. Ross (Univ. of Edinburgh). Proc. Phys. Soc. (London) A68, 110-20(1955) Feb.

A nuclear emulsion method has been used to obtain the absolute intensity of the conversion electron spectrum following the radioactive decay of AcX. The results have been used in conjunction with the other available knowledge about the decay to show that in the level scheme of An there are three strong transitions having energies of 144, 154, and 268 kev and probably a fourth of 122 kev, all of which are either pure M1 or M1 with only a small admixture of E2. All four of these transitions probably go directly to the

ground state of An. Estimates of the absolute intensities of these transitions and of several other less strong transitions have been made, and it is shown that the absolute intensity of K x-ray fluorescence is at least 0.3 and probably 0.5 quanta per disintegration. (auth)

2976

ON THE DECAY SPECTRUM OF Bi_{83}^{214}. Renato Ricci and Giacomo Trivero. Atti accad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 17, 44-6(1954) July-Aug. (In Italian)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2977

OPERATOR EQUIVALENTS AND MATRIX ELEMENTS FOR THE EXCITED STATES OF RARE-EARTH IONS. B. R. Judd (Univ. of Oxford, England). Proc. Roy. Soc. (London) A227, 552-60(1955) Feb. 8.

In recent work on the rare-earth double nitrates, it has been found necessary to extend the theory of crystal fields to cases of C_{3v} symmetry. Operator equivalences are given for the potentials V_4^3 and V_6^3, defined by $\Sigma z(x^3-3xy^2)$ and $\Sigma(11z^3-3zr^2)(x^3-3xy^2)$ respectively, and their matrix elements tabulated over a range of J (the total angular momentum) which includes the ground states of all the rare-earth ions. Operator-equivalent factors are given for certain excited levels in praseodymium and neodymium ions, and a method is described for finding these factors for levels which derive from terms that occur twice in a configuration of the form f^n. The dependence on J and J_z of the matrix elements of the crystal-field interaction between different J levels is given for the components of a crystal field with C_{3v} symmetry. (auth)

2978

THE THEORY OF THE SPECTRA OF EUROPIUM SALTS. B. R. Judd (Univ. of Oxford, England). Proc. Roy. Soc. (London) A228, 120-8(1955) Feb. 15.

A theoretical analysis is given of the three ^5D terms in the europium ion. The integrals F_k are discussed and the importance of F_6 is emphasized. Values of F_4/F_2 and F_6/F_2 are calculated for a hydrogenic 4f eigenfunction, and evidence from the praseodymium and gadolinium ions suggests it is reasonable to use these values in the case of europium. A state in L, S, L_z, S_z quantization is defined in terms of the determinantal product states of 4f one-electron states, and this enables the properties of the ^5D terms to be found. By calculating the Coulomb energies of the three terms, it is shown that the ^5D term observed spectroscopically is the lowest of the three. The relative positions of the levels $^5D_0$, $^5D_1$ and $^5D_2$ that derive from this term are calculated for Russell–Saunders coupling, and a satisfactory fit is obtained with the observed spacings. In addition, the crystal fine structures of $^7F_1$ and $^5D_1$ are related to each other, and the agreement between experiment and theory is as good as can be expected. (auth)

2979

ABSORPTION SPECTRA OF LANTHANIDE AND ACTINIDE IONS. Chr. Klixbüll Jørgensen (Technical Univ. of Denmark, Copenhagen). J. Chem. Phys. 23, 399-400(1955) Feb.

A discussion is given of the identification of transitions between states and the assignment of quantum numbers in actinides and lanthanides from absorption spectra. (L.M.T.)

2980

REPLY TO JØRGENSEN'S LETTER, ABSORPTION SPECTRA OF LANTHANITE AND ACTINIDE IONS. Robert A. Satten (Univ. of California, Los Angeles). J. Chem. Phys. 23, 400(1955) Feb.

2981

SYMMETRY OF THE LOCAL CRYSTALLINE FIELD ABOUT RARE EARTH IONS IN OCTAHYDRATED SULFATE CRYSTALS. R. A. Satten and D. J. Young (Univ. of California, Los Angeles). J. Chem. Phys. 23, 404-5(1955) Feb.

It is found from photographs and analysis of the absorption spectrum of $Nd_2(SO_4)_3 \cdot 8H_2O$ crystals that the $^4I_{\frac{9}{2}}$ ground state of the free ion splits into five levels in the crystal at 0, 76, 226, 263 and 301 cm^{-1} (good to about ± 1 cm^{-1}). From these separations it can be seen that the departure from cubic summetry is not slight. (L.M.T.)

2982

ORTHOGALLATES OF RARE EARTH ELEMENTS. Assunta Ruggiero and Riccardo Ferro. Atti accad. nazl. Lincei Rend. Classe sci. fis. mat. e nat. 17, 48-50(1954) July-Aug. (In Italian)

X-ray and crystallographic studies are reported for La, Ce, Pr, and Nd gallates. (K.S.)

SHIELDING

2983 APEX-176

General Electric Co. Aircraft Nulcear Propulsion Dept.

MISCELLANEOUS DATA FOR SHIELDING CALCULATIONS. John Moteff, comp. Dec. 1, 1954. 118p.

2984 ORNL-1840

Oak Ridge National Lab.

CALCULATIONS OF SHIELDING FOR BURNED-OUT REACTOR FUEL ELEMENTS. H. E. Stern. Dec. 22, 1953. Decl. Jan. 3, 1955. 21p. Contract W-7405-eng-26. (CF-53-12-111)

SPECTROSCOPY

2985

NUCLEAR QUADRUPOLE INTERACTION IN HCN AND DCN IN THE BENDING VIBRATIONAL MODE. Robert L. White (Columbia Univ., New York). J. Chem. Phys. 23, 249-52 (1955) Feb.

The $\Delta J = 0$, $\Delta F = 0$ transition in HCN and DCN in an excited bending mode of vibration was observed to possess structure due to an asymmetry in the electric field gradient at the nitrogen nucleus coupling to the quadrupole moment of that nucleus. A selective breaking of the π bond perpendicular to the plane of bending when the molecule assumes its ionic structure is suggested as the source of the asymmetry. (auth)

2986

MILLIMETER WAVE SPECTRA OF SbH_3 AND SbD_3. Albert W. Jache, Gilbert S. Blevins, and Walter Gordy (Duke Univ., Durham, N. C.). Phys. Rev. 97, 680-3(1955) Feb. 1.

The $J = 0 \rightarrow 1$ rotational transitions of normal and deuterated stibine have been measured in the shorter millimeter wave region. The B_0 values obtained are, in Mc/sec: 88,031.9 for $Sb^{121}H_3$, 88,015.5 for $Sb^{123}H_3$, $Sb^{123}H_3$, 44,693.3 for $Sb^{121}D_3$, and 44,677.1 for $Sb^{123}D_3$. The observed Sb nuclear quadrupole couplings, eQq, differ for the normal and deuterated forms of stibine and are, in Mc/sec: for Sb^{121}, 458.7 ± 0.8 in SbH_3, and 465.4 ± 0.8 in SbD_3; for Sb^{123}, 586.0 ± 0.8 in SbH_3, and 592.8 ± 0.8 in SbD_3. These couplings lead to the ratio $Q^{123}/Q^{121} = 1.275 \pm 0.003$. The Sb nuclear

quadrupole moments are estimated to be: $Q^{121} = -0.8 \times 10^{-24}$ cm^2, $Q^{123} = -1.0 \times 10^{-24}$ cm^2. Significant Sb nuclear magnetic coupling was observed for the normal stibine. In SbH_3 the magnetic coupling constant is found to be 0.33 Mc/sec for Sb^{121} and 0.18 Mc/sec for Sb^{123}. The ratio of these, $C^{121}/C^{123} = 1.84$, is in good agreement with the known ratio of the nuclear g factors, $g^{121}/g^{123} = 1.8465$. Slightly different values of the interatomic distances were observed for the normal and deuterated forms. In SbH_3 the Sb-H distance is 1.707 A and the H-Sb-H angle 91°18′. In SbD_3 the Sb-D distance is 1.702 A and the D-Sb-D angle 90°56′. (auth)

2987

MILLIMETER WAVE SPECTRA OF AsH_3 AND AsD_3. Gilbert S. Blevins, Albert W. Jache, and Walter Gordy (Duke Univ., Durham, N. C.). Phys. Rev. 97, 684-6(1955) Feb. 1.

The $J = 0 \rightarrow 1$ rotational transitions of AsH_3 and of AsD_3 have been measured in the one to three millimeter wave region. The B_0 values obtained are, in Mc/sec: 112,468.46 for $As^{75}H_3$ and 57,477.15 for $As^{75}D_3$. The observed nuclear quadrupole coupling, eQq, of As^{75} differs for the two species and is -160.1 ± 0.4 Mc/sec for $As^{75}H_3$ and -165.9 ± 0.4 Mc/sec for $As^{75}D_3$. Detectable As^{75} nuclear magnetic interaction was found with the magnetic coupling constant A = 0.33 Mc/sec for AsH_3 and A = ~0.07 Mc/sec for AsD_3. From a consideration of previous microwave work on AsH_2D and a consideration of the differences in the bond angles in normal and deuterated stibine, the bond angle in AsH_3 is assumed to be 91°50′ and that in AsD_3 to be 91°31′. These angles with the observed moments of inertia yield the value 1.5192 A for the As-H length and 1.5145 A for the As-D length. (auth)

2988

AN EXTENSION OF THE ANALYSIS OF THE YTTRIUM SPECTRUM. L. F. H. Bovey (Atomic Energy Research Establishment, Harwell, Berks, England). Proc. Phys. Soc. (London) A68, 79-80(1955) Feb.

Nineteen lines of the yttrium spectrum have been found in the region 9400 to 11500 A and have been assigned to term combinations in the Y I and Y II spectra. (auth)

THEORETICAL PHYSICS

2989 AECU-2998

RAND Corp.

ATOMIC ENERGY LEVELS FOR THE THOMAS-FERMI AND THOMAS-FERMI-DIRAC POTENTIAL. Richard Latter. Oct. 19, 1954. 33p. (P-585-AEC)

The eigenvalues of the Schroedinger equation have been obtained for the Thomas-Fermi and Thomas-Fermi-Dirac atomic potentials. Electron self-interactions were taken into account by modifying the potentials to give asymptotically the field of a unit charge. All levels were treated from 1s to 7d for a range of Z values sufficient to permit easy interpolation. It was found that the energies, for either the Thomas-Fermi or Thomas-Fermi-Dirac potentials, agree in general as well with experimental ionization energies as the Hartree or Hartree-Fock approximations. Applications of the statistical potential to other atomic problems are indicated. (auth)

2990 AECU-2999

RAND Corp.

SOLUTIONS OF THE TEMPERATURE-PERTURBED THOMAS-FERMI EQUATION. J. J. Gilvarry and G[len] H. Peebles. Nov. 5, 1954. 16p. [For Los Alamos Scientific Lab., Contract W-7405-eng-36, Subcontract 9 and Radiation Lab., Univ. of Calif., Berkeley, Contract W-7405-eng-48, Subcontract 64]. (P-591-AEC; RM-1420-AEC)

Previous numerical results are extended by using an analytical solution of the temperature-perturbed Thomas-Fermi equation to obtain boundary and initial parameters corresponding to seven neutral-atom zero-temperature solutions given by Slater and Krutter. Fitted functions given previously for the solution parameters in terms of the unperturbed atom radius are revised to include the new data, to obtain a considerable extension in directly-fitted range. Effects of the temperature perturbation on the equation of state are shown graphically for the extended range. (auth)

2991 ORNL-1830

Oak Ridge National Lab.

THEORETICAL RESULTS ON ORBITAL CAPTURE. N. Brysk and M. E. Rose. Jan. 25, 1955. 61p. Contract W-7405-eng-26.

Transition probabilities are exhibited for the K shell and all the L subshells for various orders of forbiddenness. The relative contributions of the subshells are examined, with special attention to the hitherto neglected p-electrons. The circumstances under which p-electron capture is appreciable and under which it may become even more important than s-electron capture are pointed out. All calculational details on which the results are based are given. In particular, the wave functions for the bound-state electrons are corrected for the finite size of the nucleus and the effect of screening. In addition, consideration is given to the variation in the electron wave functions over the nuclear volume. (L.T.W.)

2992 OSR-TN-55-42

Stanford Univ.

LATTICE SPACE QUANTIZATION OF COUPLED MESON AND NUCLEON FIELDS. D. H. Holland. Jan. 1955. 18p. Contract AF18(600)-545, Technical Report No. 10.

The lattice space quantization method used by Schiff for treating nonlinear mesons is used in quantizing coupled mesons and nucleon fields. Neutral pseudoscalar mesons with pseudoscalar coupling to neutral Dirac nucleons are assumed. Only the fields at the lattice points of a cubic lattice are considered. An appropriate lattice space Hamiltonian is found and momentum (gradient) terms are treated as perturbations. To zero order the lattice points are uncoupled, so the state function can be written as a product of functions describing a single point. In the representation chosen, finding a particular point function entails the solution of a set of coupled differential equations. These equations can be solved in principle with no assumptions as to the magnitude of the coupling constant g, but they require numerical integration and have not been solved. Linear combinations of the zero-order solutions are found which diagonalize the perturbation to lowest order and can be interpreted as one-particle momentum eigenstates. The perturbation energy of these states includes a term proportional to k^2 which is interpreted as the kinetic energy. Linear combinations of two-particle momentum eigenstates are found which approximately diagonalize the perturbation, and from these, scattering cross sections are calculated. The lattice constant l appears in the final results and must be regarded as a parameter of the theory. In order that the perturbation

approximation be valid, l must be much larger than the meson Compton wavelength. (auth)

2993

EXCITED STATES OF VERY SHORT MEAN LIFE AND CHARGE INDEPENDENCE. Bernard d'Espagnat. Compt. rend. 240, 164-6(1955) Jan. 10. (In French)

Several consequences of the hypothesis of charge independence and the formation of intermediate excited states are obtained for the case where the mean life of such a state is very short. The results are applied to the problem of meson production. (tr-auth)

2994

ON THE QUESTION OF UNITARITY OF S MATRICES IN QUANTUM THEORY OF FIELDS WITH NONLOCAL INTERACTION. B. V. Medvedev (Steklow Mathematics Inst.). Doklady Akad. Nauk S.S.S.R. 100, 433-5(1955) Jan. 31, (In Russian)

2995

EXCITATION OF MOLECULES IN THE BETA DECAY OF A CONSTITUENT ATOM. H. M. Schwartz (Univ. of Arkansas, Fayetteville). J. Chem. Phys. 23, 400-1(1955) Feb.

Several authors have reported theoretical studies of atomic excitation in beta decay. This note summarizes initial results for the corresponding molecular problem. (L.M.T.)

2996

NOTES ON INTERMEDIATE COUPLING THEORY. M. Maurice Jean (Institut du Radium, Paris, France). J. phys. radium 16, 75-7(1955) Jan. (In French)

The Tomonaga approximation for the case of the pseudoscalar meson is extended to a nucleon system whose spin is greater than ½. (K.S.)

2997

MATRIX ELEMENTS IN SUPERALLOWED TRANSITIONS. Mark Bolsterli and Eugene Feenberg (Washington Univ., St. Louis, Mo.). Phys. Rev. 97, 736-42(1955) Feb. 1.

The nuclear matrix element for superallowed transitions between two states of an isobaric spin multiplet can be expressed in terms of a diagonal matrix element of the spin operator difference $S_n - S_p$. Known theoretical results on the nuclear matrix element in image transitions are summarized, and the methods which have proved useful in the study of image transitions are extended to superallowed transitions within the lowest T = 1 isobaric spin multiplet in the 4n series. Experimental results indicate the actual occurrence of such transitions in Na^{20}, Al^{24}, P^{28}, Cl^{32}, and Sc^{40}. (auth)

2998

RENORMALIZATION OF A COVARIANT APPROXIMATION SCHEME IN FIELD THEORY. R. Arnowitt and S. Gasiorowicz (Univ. of California, Berkeley). Phys. Rev. 97, 823-30 (1955) Feb. 1.

An approximation scheme for the one-nucleon Green's functions previously put forward by the authors is renormalized. The experimental mass and the contants Z_1 and Z_2 are rigorously expressed as free-particle limits of integrals over the kernels appearing in the scheme. The mass and wave-function renormalization are carried out rigorously; the vertex renormalization is performed by a slight redefinition of the approximation scheme, without greatly altering the physical assumptions peculiar to each approximation. General prescriptions for renormalization are written down, and the first three approximations are explicitly shown to be finite. (auth)

2999

THE RELATION BETWEEN ZERO-ENERGY SCATTERING PHASE-SHIFTS, THE PAULI EXCLUSION PRINCIPLE AND THE NUMBER OF COMPOSITE BOUND STATES. P. Swan (University Coll., London, England). Proc. Roy. Soc. (London) A228, 10-33(1955) Feb. 15.

It is shown that for the interaction of systems described by integro-differential equations, such as the scattering of electrons by atoms or of nucleons by deuterons, tritons and other nuclei, that the zero-energy scattering phase-shift is $(n + m)\pi$, where n is the number of composite bound states of the impacted and incident particles, and m is the number of states from which the incident particle is excluded by the Pauli principle. Each of these excluded states corresponds to a solution of the integro-differential equation asymptotic to $e^{-\gamma r}$ for which the complete wave function vanishes identically, and which therefore does not represent a bound state. It is possible to predict the zero-energy phase-shift without calculation by a knowledge of the composite bound states and of the distribution and quantum numbers of the elementary particles contained in the impacted and incident systems. (auth)

URANIUM AND URANIUM COMPOUNDS

3000

PREFERRED ORIENTATION IN ROLLED URANIUM SHEET. J. Adam and J. Stephenson (Atomic Energy Research Establishment, Harwell, Berks, England). J. Inst. Metals 82, 561-7(1954) Aug.

Preferred orientations produced in flat uranium plates rolled in the α range with light or heavy total reductions, are reported. A simple description of the deformation texture of rolled uranium as a mixture of grains with (0 1 0) and (1 1 0) planes oriented perpendicular to the rolling direction is accurate for high temperatures and a high total rolling reduction. Textures observed in plates rolled below 500°C agree with predictions based on twinning modes of deformation. (auth)

3001

STUDIES OF ABSORPTION SPECTRA. VI. ACTINIDE IONS WITH TWO 5f-ELECTRONS. Chr. Klixbüll Jørgensen. Kgl. Danske Videnskab. Selakab. Mat.-Fys. Medd. 29, No. 7, 1-21(1955).

The absorption spectrum of uranium (IV) ions is interpreted as the atomic spectrum of the free ion with little influence from crystal fields. It is compared with the theoretical predictions of CONDON and SHORTLEY for systems with two f-electrons. The identification is supported by the behaviour of the spectrum of different complexes and by a new band in the ultraviolet. The energy levels are related to the actinide hypothesis, and chemical conclusions are drawn from the absence of very strong absorption bands. (auth)

3002

FAST-FISSION CROSS-SECTION OF U^{235} AND U^{238}. Nenad Raisic (Joint Establishment for Nuclear Energy Research, Kjeller, Norway). Nucleonics 13, No. 2, 67-8(1955) Feb.

The ratio between the fission cross section of U^{238} and U^{235}

and the (n,α) cross section of B for fission-spectrum neutrons has been obtained. The counting-rate ratio was measured between a BF_3 counter and a proportional counter containing foils of natural and enriched U. Thermal neutrons were eliminated by a Cd shield. The influence of epithermal neutrons was determined by measuring the counting-rate ratio between a Li and a BF_3 counter. The fission–B cross section ratios obtained for fission spectrum neutrons are $\bar{\sigma}_{fiss}\,U^{238}/\bar{\sigma}_B = 2.95 \pm 0.3$ and $\bar{\sigma}_{fiss}\,U^{235}/\bar{\sigma}_B = 17.5 \pm 8$. With 0.091 b for the B(n,α) cross section, the fission cross sections are calculated to be $\bar{\sigma}_{fiss}\,U^{238} = 0.27 \pm 0.03$ b and $\bar{\sigma}_{fiss}\,U^{235} = 1.6 \pm 0.8$ b. The large error for U^{235} is mainly due to the uncertainty of the isotopic ratio in the enriched U. (M.P.G.)